REGD. No. M. 2799. SUPPLEMENT: INDIAN SCIENCE CONGRESS, BARODA, 1942

Current Science

Vol. 11, No. 1 JANUARY 1942 Pages 1-36

CURRENT SCIENCE

INDEX TO VOL. XI, 1942

AUTHOR INDEX

	Page
A. A.	23
Abraham, A.	58, 112, 282
Ahmad, S.	433
Airan, J. W.	246, 291, 400
Aiyappan, A.	76
Aiyar, R. Gopala	56
A. K. Y.	35, 120, 165, 254, 477, 479, 480
Alikunhi, K. H.	56
Amrute, P. V.	403
Ananthakrishnan, S. V.	202
A. N. K.	65
Appanna, T. C.	333
Apte, V. V.	59
A. S. R.	446
Asundi, R. K.	473
Auluck, F. C.	430
A. V. S.	450, 477
Ayyangar, A. A. Krishnaswamy	51, 459
Baaqui, Mohd. Abdul	188
Banerji, A. C.	269
Barave, R. V.	403
Basak, R. G.	392
Basir, M. A.	195
Basu, U. P.	290
Batliwala, K. C.	357
B. B. D.	445
B. G. L. S.	379
Bhagvat, Kamala	331, 394
Bhatnagar, Sir S. S.	171
Bose, A. B.	439
Bose, A. N.	281
Bose, B. C.	435
Bose, I. B.	432
B. R. S.	144, 293
B. S.	237
B. S. B.	117, 249
B. S. M.	163
B. V.	145, 446
B. V. R.	18
Cawston, F. Gordon	329
Chacko, P. I.	108, 242, 404
Chakravarty, G. K.	441
Chaubal, A. S.	418, 452, 481
Chaudhuri, Rafi Mohammed	188
Chidambaram, K.	289, 406
Chinoy, J. J.	400
C. V.	21
Dastur, N. N.	294
Datar, B. N.	115
Deliwala, C. V.	103
Deshpande, G. S.	466
Desouza, Miss V.	462
Devadatta, S. C.	333, 463
Devanesen, D. W.	16, 142, 242, 398
Dey, B. B.	110, 207, 419, 444
Dey, N. K.	432
Dhar, N. R.	409
Dikshit, B. B.	158
Dixit, S. C.	107
D. N. M.	235
Doss, K. S. Gururaja	15
D. S. S.	472
Dunnicliff, H. B.	247
Dutt, B. K.	366
Dutt, N. K.	104, 435
D. V. G.	1
E. K. R.	200
Fowler, Gilbert, J.	37
G.	473
Ganapathi, K.	103
Ganguli, S. K.	281
Gates, Prof. R. Ruggles	127
Gopalakrishnan, C.	36, 118, 250
Gopala Rao, G.	102
Gopinath, D. M.	286
Gopinath, K.	337
Gordon, D. S.	157, 162, 201, 249
Gorrie, R. Maclagan	114
Govindachari, T. R.	238
Greval, S. D. S.	423
G. T. K.	167
Gundappa, D. V.	219
Hedayetullah, S.	109
Heilig, Robert	204, 256, 257
Hora, S. L.	470
Ingle, P. M.	335
Iyengar, C. V. Krishna	443
Iyengar, G. Narasimha	55
Jagadeo Singh	52
Jambunathan, M. V.	413
J. C. C.	369
Job, T. J.	73
John, C. C.	243, 407
Joshi, K. G.	335, 402, 465
Joshi, W. V.	242
Kalamkar, R. J.	190
Kale, G. T.	373
Kanvinde, C. K.	397
K. B.	414
Khanolkar, V. R.	325
Khastgir, S. R.	392
Kishen, K.	98
Kosambi, D. D.	227, 270
Kothare, A. N.	397

	PAGE
Kothari, D. S.	430
Krishnaswamy, B. L.	397
K. R. K.	478
K. S. G. D.	77, 83, 254
Kulkarni, G. S.	246
Kumar, L. S. S.	58, 112, 241, 242, 338, 434
K. V.	67
Lal, M. B.	345, 388, 467
Lamba, B. S.	54
Lowe, J.	447
Mahabale, T. S.	466
Mahajan, L. D.	62
Majumdar, D. N.	153, 353
Mallik, A. K.	288
Menon, M. A. S.	243, 407
M. J. T.	23, 78, 122, 255, 299, 344, 415, 477
Mohamad Ali	411
Moorthy, V. N.	358
M. R. A.	476
M. R. B.	23
M. S.	341
Mukerji, B.	61, 104, 198, 432, 435
Mukherji, S. P.	279
Murthy, B. K.	119, 300
Murthy, M. Prabhanjana	52
Murthy, S. Narasimha	284
Nadkarni, V. V.	397
Naidu, P. R. J.	192
Namjoshi, A. N.	463
Narasimha Iyengar, G.	55
Narayanaswamy, B. V.	72
Narlikar, V. V.	6, 390, 391, 445
Nataraj, S.	468
Natarajan, S.	245
N. B. B.	379
Padmanabhan, S. Y.	150
Padwick, G. Watts	246
Pandit, U. P.	288
Panditrao, D. B.	402
Palit, S. R.	13
Pantulu, J. V.	152
Paramasivan, S.	190
Parthasarathy, N.	150, 194
Parthasarathy, S.	171
Patel, B. V.	187
Patwardhan, G. K.	391
Pillai, S. C.	437
Pisharoti, P. R.	10
P. M. N.	34
Puntambekar, S. V.	464
Puri, A. N.	156
Rafay, S. A.	150
Rajagopal, K.	52
Rajagopalan, S.	146, 394
Ramachandran, K.	149
Ramacharlu, P. T.	102
Ramamurti, K. K.	460
Raman, Sir C. V.	44, 85, 93, 225, 247, 261, 303, 453
Raman, P. K.	231
Ramanujam, S.	426
Ramaswami, L. S.	106
Ramaswami, S.	53
Ramaswamy, S.	276
Ramdas, L. A.	288
Ranganathan, S. R.	21, 76, 121, 162, 253, 296, 342, 378, 414, 449, 474, 476
Rangaswami, M. R.	27, 81, 125, 167, 216, 259, 302, 346, 383
Rangaswami, S.	367
Rao, A. Madhava	149
Rao, A. Narasinga	212
Rao, A. N.	410
Rao, A. R.	405
Rao, B. Ananthaswamy	212
Rao, B. S.	66, 248
Rao, Basrur Sanjiva	15
Rao, C. Narasinga	399
Rao, G. G.	65
Rao, G. Gundu	273
Rao, K. Narahari	357
Rao, Kittur Subba	11
Rao, M. A. Venkata	407
Rao, M. Rama	430
Rao, M. R. Srinivasa	396
Rao, N. K. Anantha	442
Rao, N. Rajeswara	13, 429
Rao, P. Suryaprakasa	360
Rao, S. Krishnamurthy	412
Rao, S. Ramachandra	460
Rao Saraf, J.	101
Rao, Y. K. Raghunatha	189
Rau, M. A. G.	68, 116, 248, 251
Rau, Y. V. S.	149
Reddy, D. V. S.	60, 111, 155
Reddy, K. Rami	411
Rege, A. V.	291
R. K. A.	18
Row, Y. Subba	311
Saha, J. C.	109
Sahni, B.	156, 369, 371
Sane, P. V.	59
Saran, Brijmohan	360
Sarkar, S. N.	239
Sarma, P. S.	53, 331, 332, 394
Sarma, R. Nagaraja	293, 408
Sastri, B. N.	336
Sastry, S. G.	183
S. B.	118
S. D. A.	254, 297
Sen, A. T.	364
Sen, H. K.	161
Sen, T. N.	239
Seshachar, B. R.	439
Seshachar, C.	364
Seshaiyengar, M.	12, 276
Setna, S. B.	469
Shah, S. V.	246, 291, 400
Sharada Bai, Miss G.	15
Shirsat, M. V.	103
Shiveshwarkar, S. W.	355
Siddiqui, S.	278, 368
Singh, Balwant	367
Singh, Bawa Kartar	96, 360
Singh, B. N.	442
Singh, Jagdeo	52
Singh, Nand Lal	276, 330
Sivaramakrishnan, P. R.	336
Soni, B. N.	280
Sreenivasan, P. S.	287
Sreenivasaya, M.	53, 147, 332, 462
Srinath, K. V.	59
S. R. S.	340, 450
Subramanian, K.	22

	Page
Swaminathan, K.	16
Swamy, B. G. L.	109, 147, 285, 332
Swamy, S. Rama	276
Telang, M. S.	461
T. G. A.	76
Thakurta, A. Guha	366
Thirumalachar, M. J.	197, 282, 363
Thomas, P. J.	456
T. L. R.	297
T. P. B.	27, 78, 81, 125, 168, 217, 260
T. S. S.	19, 67
Vachha, S. B.	107
Vaidya, P. C.	390, 391
Vaidya, V. G.	335
Vatchagandhy, J. S.	292
Venkataraman, K.	47
Venkataraman, K. (A.I.R.)	185
Venkatraman, Sir T. S.	150, 194
Venkataramiah, C.	60
Venkateswarlu, K.	100
Viswanadham, C. R.	102
Viswanath, B.	135
V. R. T.	213
V. S. G.	292, 299, 344, 372, 379, 399, 476
Wadia, D. N.	351
Wooltorton, F. L. D.	364
W. R. A.	375
Yeshoda, K. M.	360
Y. K. R.	23

TITLE INDEX

	Page
Absorption Spectra of Potassium Permanganate in Different Media	52
Academies and Societies	29, 84, 126, 169, 218
Adrenaline, Preparation of, from Suprarenal Glands	444
— Powder, Pressor Effect of, On the	281
— Solutions, Potency of, Standardisation of	435
Agar, Reclamation of	344
Agmark, The Story of	215
Agricultural Products as Insecticides	255
— Research in India, Progress of	120
Aircraft and Gliders, Indian Timber for	345
Alcoholism and Thiamin	343
Algal Parasites and Diseases	255
All-India Library Conference, 1942	167
American Bagging Problem, Indian Jute Industry and the	343
Analytical Chemistry of Industrial Poisons, Hazards and Solvents (Rev.)	247
— Processes—A Physico-Chemical Interpretation (Rev.)	248
Andhra University	124
Animal Life (Rev.)	293
Anisomeles sp., Endosperm Formation in	284
Annamalai University	482
Anolobine, Constitution of	238
Anthropological Survey of the People of the U.P.	50
Anti-Malarial Drug in India, A Cheap	275
Anti-Malarials, Malaria and	347
Apoda, Heart and Circulation in	214
Argemone Oil, Detection of, Chemical Test for	279
Art, Science and	355
Ascorbic Acid, Magnesia as an Adsorbent for	336
Aspiromitus st. from Bor-Ghat (Lonavala & Khandala), Two New Species of	59
Astronomical Notes 27, 81, 125, 168, 216,	260
Atmospherics, Distant, Received in Medium Frequency Channels, Sunrise Maxima in the Intensity of	392
Automobiles with Petrol-Alcohol Mixtures, Road Tests of	55
Babesia foliata n.sp. from a Sheep	254
Bacteriological Examination of Blood, Stools and Urine of Suspected Cases of Typhoid Fever	358
Bagasse, Insulation and Pressed Boards from	164
Balanoglossus as Food of Fishes	242
Band Spectrum of Phosphorus and Nuclear Spin, Structure of the	357
Bauxite Deposits in South India	417
Beidellite Membranes, Electrical Properties of	476
Berberis aristata D.C., *Puccinia droogensis* Butler on	282
Berliner, Dr. Arnold (Obituary)	425
Beryllium Coppor Alloys	387
Bhatnagar, Sir Shanti Swarup, Commemoration Volume (Rev.)	156
Bibliography, Reference Service and (Rev.)	373
Bio-Assay on Tadpoles of Thyroxine and Similar Preparations	104
Biochemistry, Annual Review of (Rev.)	340
Biological Abstracts	28
——, A New Section (F.)	217
— Stations in India, Urgent Need for, The	33
Blackout Bulb, A New	343
Blood Banks	423, 482
— Groups in India	297
—— of the Bhils of Gujarat	353
—— of of the Doms, The	153
Bombay University	80
Bragg, Sir William Henry, O.M., F.R.S.	93
Board of Industries and Commerce in Mysore	258
Boron Monoxide, A New Band-System of	276
3-Bromo-Salicylic Acid, Preparation of	397
Cæsalpiniaceæ, Chromosome Numbers of Some	152
Calcium Gluconate, Manufacture of	299
Calcutta University	124, 216
Camallanus salmonæ, A New Nematode from Kashmir	441
Cancer Research in India	325

	PAGE
Carica, Chromosome Number in	58
Caridina (*Atyidæ decapoda*) in Travancore, On the Occurrence of	245
Carnegie Institution of Washington (Rev.)	341
Cassia occidentalis Linn., An Abnormal Flower of	405
Catalysis of Dichromate-Hydriodic Acid Reaction by the Oxalate ion	102
—, Inorganic and Organic (Rev.)	409
Cathode-Ray Tube (Rev.)	472
Celestite in Cis-Indus Salt Range	54
Cellulose, Chemistry of, An Introduction to the (Rev.)	410
Cement as a Fire Extinguisher	298
Centenaries 21, 76, 121, 162, 253, 296, 342, 378, 414, 449,	476
Charcoal for Buses and Lorries	123
Chemical Engineering, Applications of, The (Rev.)	65
— Industries, in India, Heavy	183
— Kinetics of Organic Reactions, Mechanism and (Rev.)	202
— Species (Rev.)	65
— Technology, Department of 24,	477
Chemistry of Industrial Poisons, Hazards and Solvents, The Analytical (Rev.)	247
—, An Introduction to (Rev.)	66
— of the Anti-Pernicious Anæmia Substances of Liver	311
—, Inorganic, Modern (Rev.)	412
—, Organic (Rev.)	445
—, Physical, Text-Book of (Rev.)	66
Chemotherapeuticals, Possible Lipophilic, of the Sulphanilamide Group, Synthesis of	394
Chickens, Nutritional Experiments with	297
Chinese Lessons to Western Medicine (Rev.)	204
Chlorophæite Bearing Basalts from the Cuddupah Traps (Pre-Cambrian)	396
Chlorophyll, State of, in the Chloroplast	442
Chomelia asiatica O. Kze., A New Species of *Puccinia* on	197
Chromatographic Removal of the Growth-promoting Factors from Natural Glycerides	462
Chromosome Counts in the Sugarcane and Its Hybrids	194
— Numbers of Some Cæsalpiniaceæ	152
— — in *Tinospora*	282
Clay, Burnt, or Surkhi as Pozzalana (Rev.)	68
Coconut, The Ripening	480
Coefficient of Contingency, Improved Formulæ for the	51
Coin Accessions in the Madras Museum	76
Coleoptile of *Zea Mays*, Rate of Elongation of the, Variation in the	443
Colours, Adsorption and Display of	11
Combustion Engines (Internal), Manufacture of	82
— Theory, Spectroscopy and (Rev.)	473
Concepts of the Solid State, New	85
Conical Refraction, Phenomena of	44
Control Laboratory, Central Revenues	79
Cork Substitute	416
Cotton Textile Industry, Indian	119
Cotton, Quality of, in Hyderabad	380
— Root-rot of, as Influenced by Inter-Cropping	165
Cotton Seed, Pre-treatment of, with Ammonium Sulphate	190
— —, Longevity of, Factors affecting the	477
Cubes, On Latin and Hyper-Grcæo-Latin and Hyper-Cubes	98
Cuddupah Traps, (pre-Cambrian), Chlorophæite Bearing Basalts from the	396
Currency, Metal, Weight of, Effect of Circulation upon the	227
Current Density at the Cathode of a Glow Discharge through Gases	188
Dacca University	258
Dakhan, Pre-historic	34
Decapod Larvæ from Madras Plankton	78
Delhi University	80
Depolarisation of Light Scattered by Sols	254
Diamond, Physics of the	261
Diesel Engines, Groundnut Oil for	403
Diffusion in and through Solids	116
Dipole Moments in Chemistry	117
Dried Fruits, Manufacture of, from N.W.F.P.	255
Drug in India, A Cheap Anti-Malarial	275
Dry Cells in India, Manufacture of (Rev.)	20
Dust Devil at Poona on the 27th March 1942, An Unusually Long-lived	231
Ecology—Theory and Practice	32
Economic Science, Research in	456
Education in India, 1937-38 (Rev.)	157
— — —, 1938-39 (Rev.)	201
— Department, London, Report on, (1939-40) (Rev.)	249
Eigen-Value Problems, (Solving), by Factorisation	213
Electricity, Intermediate (Rev.)	67
— and Magnetism, A Text-Book of (Rev.)	19
Electrokinetic Potential, Effect of Organic Dye Ions on the	77
Electrolytes, Strong, Electrolytic Dissociation of, Effect of Common Ion on the	13
Electrotechnics (Rev.)	19
Embryology, Histology and, Practical (Rev.)	446
Endosperm Formation in *Anisomeles* sp.	284
Engineering, Chemical, Applications of, The (Rev.)	65
— Industry, Education for the	36
Ephestia kuehniella Zell., Pupation of	122
Ergometrine Solution, Determination of	432
Ergot Cultivation	344
— in India	246
—, Germination of	439
Erosion in Cultivated Uplands	344
Ethyl-Alcohol-Water System, Fractional Distillation of, Plate Factors in the	23
Fat in Milk, Determination of, A Cheap Substitute for Amyl Alcohol used in the	16
Fatty Oil from the Seeds of *Mallotus philippinensis* Muel.	464
— Oils from the Seeds of *Momordica charantia* and *Momordica dioica* (N.O. *Cucurbitaceæ*)	246
Ferrous Alloys and Foundry Materials, Chemical Analysis of (Rev.)	411
Fine Chemicals, Manufacture of, Synthetic Drugs and	47
Fish Liver Oils, Vitamins A & D Content of	450

	PAGE
Fishes, Post-larval, of the Trivandrum Coast, Distribution and Feeding of	337
Fisheries Technological Institute, Tuticorin	257
— of the Union of South Africa (Rev.)	73
Flame Spectra, Arc Lines of Copper in	330
Flax (*Linum usitatissimum*), Sterility in, A Preliminary Note on the	286
Flora of the Bailadila Range	477
Food—The Deciding Factor (Rev.)	372
— Position, Our	135
— and Feeding Habits of the Oil Sardine and Mackerel	243
Foods, Dehydration of	450
—, Indian, Nutritive Value of, and the Planning of Satisfactory Diets (Rev.)	68
— Supply, Some Factors in	37
Foundry Materials, Ferrous Alloys and, The Chemical Analysis of	411
Forest Research in India and Burma	122
Fuel Forests, Dry, Artificial Regeneration of	77
Galois Lectures No. V (Rev.)	67
Gametophytes of Some Liverworts and Pteriphytes, A Method of Sectioning the	367
Gases, Photochemistry of, The (Rev.)	369
Gegenophis carnosus Bedd., Eggs and Embryos of, The	439
Genetics (Human), Heredity and Environment in	127
— and Plant Breeding, Indian Journal of, The	4
Geography of Kerala, Regional, Some Aspects of	32
Geological Department, Mysore	24
Geology of Ceylon	298
Geological, Mining and Metallurgical Society of India	376, 382
Geometry, A Manual of (Rev.)	412
Ghee, Vegetable, Colourisation of	77
Glandular Products, Chemistry and Therapy of	207
——, in India, Manufacture of 110, 198, 290	444
——, The Manufacture of: The Organisation of Our Slaughter Houses	419
Glycosuria in Pregnancy, Incidence and Causation of, A Preliminary Note on the	357
Gourami (*Osphromenus gorami*), Lacepede, Fungus Disease of, in a Pond at Madras	289
Grape Cultivation in India	78
Groundnut Oil for Diesel Engines	403
Heterakis tragopanis, A New Species of the Genus *Heterakis* from the Intestine of a Crimson-horned Pheasant	388
Hexoses, Chemistry of, Emil Fisher's Work on the	96
Hibiscetin, Constitution of	360
Hilsa Fish, Migration of, in Indian Waters, Effect of Dams on the	470
Histology and Embryology, Practical (Rev.)	446
Honeys, Vitamin Content of	414
Horticultural Society of India	167
Human Voice, Mechanism of the (Rev.)	247
Hypoderma crossi Patton, Eggs of the Goat Warble-Fly	280
Ichthyopis glutinosus Linne (Apoda), The Stapedial Connections in	106
Impatiens, Root-forming Hormone in, Velocity of Longitudinal Transport and Transverse Translocation of	366
Imperial Veterinary Research Institute	257
India, Making of, The	30
— Meteorological Department—Work at the Agricultural Meteorology Section	25
—, Study of, in Post-Revolutionary Period, by Russian Scientists	421
Indian Academy of Sciences	73
— Central Cotton Committee	79, 381
— Ceramic Society	300
— Ecological Society	79, 215
— Eugenics Society	144
— Forest Rangers' College, Dehra Dun	79
— Geographical Association	125
— Central Jute Committee	123, 416
— Jute Industry and the American Bagging Problem	343
— Lac Cess Committee	122
— Lac Research Institute	450
— Mathematical Society	212
— Science Congress, Election of Presidents for 1943 Session	28
— Scientists (Rev.)	413
— Statistical Conference, 1943	482
—— Institute	217, 257
— Timber for Aircraft and Gliders	345
— Wool, Quality of	300
— Woods for Battery Separators, Suitability of	479
Indo-European Trade Link	213
Indo-Greek Bronze Coins from Taxila, Metallography of	190
Industries in India, Development of	224
Industrial Research Fund	479
Insect Nutrition: Biological Assay of Thiamin with *Corcyra cephalonica* Staint., as the Experimental Animal, Studies in	332
——, —: Assay of Quality in Crops	53
——, Studies in—Symptomology of Avitaminosis in *Corcyra cephalonica* Staint., A Historical Study	147
Insecticides, Vegetable, in India	343
Inter-University Board, India (Rev.)	162
Iron and Steel Works, Economic Control of (Rev.)	292
Irrigation, Central Board of	381
— Research	24
—— in India (Rev.)	250
—— Institute, Punjab	118
Jurassic Rocks of Cutch	451
Jute, New Uses for	26
— Shoes, Manufacture of, and Other Extended Uses of Jute	380
— Yarn Tests	256
Khaki Shade from Vegetable Raw Materials, The Production of	166
Kraft Paper from Bamboo	380
Krishnan, Prof. K. S.	216
Lady Tata Memorial Trust	82, 258
Landscape (Rev.)	114
Lantana, Eradication of	163
Library Conference, All-India	167
Light, Polarisation of, Scattered by Isotropic Opalescent Media	450

	PAGE
Liquid State, Nature of the	303
Liver, Anti-pernicious Anæmia Substances of, The Chemistry of the	311
Living Animals, Experiments on Regulations of	281
Locust Delegation, Indian, to Iran	139
— Situation in Northern India	123
Lucknow University	216
Madras Government Museum and Connamara Public Library, Administration Report of (Rev.)	447
— University	216
Magnesia as an Adsorbent for Ascorbic Acid	336
Magnetic Notes 27, 81, 125, 167, 216, 259, 302, 346, 383, 418, 452,	481
Magnetism in Relation to Chemical Problems (Rev.)	158
Malaria in Indian Cantonments, Drive Against	212
— and Anti-Malarials	347
Mallotus philippiensis Muell. Arg. (Natural Order Euphorbiaceæ), The Fatty Oil from the Seeds of	360
Mammals and Birds, Fertility in	22
Mango, Propagation of the, Studies on	165
Manures, Nitrogenous, to Cotton, The Application of	479
Marine Fauna, Mortality of, An Unusual Incidence of	404
Marketing in India:—Marketing of Rice, Groundnuts, Potatoes and Jute (Rev.)	69
Metals, Non-Ferrous	385
Meteorological Department, Burmah	78
Maternal Mortality, Causes of, in the City of Bombay	256
Mathematical Tables, Physical Constants and, Handbook of (Rev.)	472
Matter and Energy (*Dravyamu-Sakti*) (Rev.)	446
Mechanics, Classical and Quantum	163
Mechanism and Chemical Kinetics of Organic Reactions (Rev.)	202
Medicine, Indigenous System of, Committee on	382
—, Tropical, A History of (Rev.)	155
—, Western, Chinese Lessons to (Rev.)	204
Medicinal Plants in India	165
Membrane Manometer, Photo-Electric	379
Metal Drums and Cans, Substitute for	299
Metallurgical Research, Department of, and Research Workshop of Mechanical Engineering at the Indian Institute of Science	140
Military Studies, Diploma in	80
Milk-Fish (*Chanos chanos*), Larvæ of, A Note on Rearing	168
Milk Industry, Salvage in the	214
— in Relation to Health	294
Mineral Metabolism (Rev.)	199
Mineralogist, Government of Ceylon, Administration Report for the Year 1941, Pt. II—Revenue	478
Moisture, Movement of, through the Soil, The Influence of Packing on the	288
Momordica charantia and *Momordica dioica*, Seed of, Fatty Oils from the	246
Morphological Studies in Three Species of *Vanda*	285
Morphology of Insects in Relation to Habit, Certain Aspects of	33
Mosaic, Strains of, Antagonism between	477
Mosquito Control, Pyrethrum in	378
Mudaliar, Dr. A. Lakshmanaswamy	5
Multiple Observations, A Test of Significance for	271
Mustard Oil, Toxicity of, Samples Prepared from Mustard Seeds and Cakes Undergoing Microbial Decomposition	239
Mysore University	80
Myxosporidia from Sharks, Preliminary Observations on	469
Nagpur University	215, 481
Narasimhamurthy, Dr. V. (Obituary)	413
Narayan Rao, Prof. C. R.	4
National Institute of Sciences of India	74, 481
— Registry of Rare Chemicals	383
Neanderthal Man and His Culture in Central Asia	76
Nepopteryx engraphella Rag., A Pyralid Caterpillar Pest	23
Newsprint, Manufacture of	26
Newton and the History of Optics	453
—, Mathematics, and Ramanujan	474
Nim Oil, Bitter Principles of the	278
— —, Bitter Principles from, Three New, A Note on the Isolation of	278
Non-Ferrous Metals	385
Nutrition, Public Health and	415
— Society, The	95
Nutritional Experiments with Chickens	297
Nutritive Value of Fish and Prawn Muscle, Comparative Studies in	333
Oil, Fatty, from the Fruit of *Martynia diandra* (*N.O. Pedaliaceæ*)	291
—, Sardine and Mackerel, Food and Feeding Habits of the	243
—, Shark Liver, Unusually Rich in Vitamin A, A Sample of	52
Olpidium uredinis parasitic within the Uridiospores of *Hemileia canthii* Berk. and Broome	363
Optical Instruments, Manufacture of	26
Optics, History of, Newton and the	453
Opuntia decumana, Reverse Mutation in	338
Organic Compounds, Identity of, Confirmation of the, Application of X-ray Methods to the	276
Organic Chemistry (Rev.)	445
Oswaldocruzia, the Nematode Genus, The Occurrence of	345
Palæobotany in India	416
Palme, Embryological Studies in, (A Preliminary Note on the Megasporogenesis in *Areca catechu* Linn.)	109
Panikkar, Dr. N. Kesava,—Appointed Professor of Zoology, Travancore University	124
Paper from Grass	255
Parachute Dropping, Containers for	299
Pargasite in Mysore, The Occurrence of	192
"Pectin", from Tamarind Seeds	379
Phanerogamic Parasite of Sugarcane in Bengal	109
Phasic Development, Pre-Sowing Treatment and	400

	PAGE
Phenylhydrazine Anæmia in Rats ..	360
Phenothiazine, Anthelmintic Action of	254
Philosophy, Studies in .. 293,	407
Phosphorus in Sewage, The Nature and Fertilising Value of	465
— and Nuclear Spin, Band Spectrum of, Structure of the	357
Photochemical Analysis	102
Photochemistry, Pure and Applied, Certain Aspects of 31,	83
— of Gases, The (Rev.)	369
Photoelectric Efficiencies of Some Metals in the Soft X-ray Region	460
Physical Chemistry, Experimental (Rev.)	248
— —, Text-Book of (Rev.)	66
— Constants and Mathematical Tables, Handbook of (Rev.)	472
Physics, Intermediate (Tamil), A Text-Book of	116
—, Practical, for Intermediate Students (Rev.)	472
—, Progress in, Reports on (Rev.) ..	18
Physiological and Pharmacological Research in India, The Expansion of, Need for the	34
Physiology, Recent Advances in (Rev.) ..	158
—, Sex and Reproductive, Recent Advances in (Rev.)	446
Pilot Plants as a Basis for the Design of Large-Scale Equipment	251
Pine Wool, Manufacture of	255
Planetary System, Formation of the, Radial Oscillations of a Star and the ..	161
Plankton Studies in the Fisheries Branch of the Department of Industries and Commerce, Madras	142
Plant Cell, The Cytoplasm of the (Rev.)	371
— Sciences, A Short History of (Rev.)	369
— Science Formulæ (Rev.)	156
Plastics in Industry (Rev.)	472
Platinum Wire, Rotating Micro-electrode of, Voltametric Determinations and Amperometric Titrations with ..	23
Politics, International, Science and ..	127
Polyembryony, False, in Viviparous *Rhizophora mucronata* Lam.	242
—, Non-heritable, in *Andropogon sorghum*	241
Polyploidy in Crop Plants, Induction of ..	112
Post-Mortem and Histological Changes in Some Tissues of Rats Fed on Mustard Oil Samples Prepared from Mustard Seeds and Cakes undergoing Microbial Decomposition	239
Prawn Fauna of Travancore, A Note on the	468
Prehistoric Expedition, Gujarat ..	120
Pre-Sowing Treatment and Phasic Development	400
Progress, Idea of, Eastern and Western ..	219
Prothrombin Time, An Improved Method for the Determination of .. 60, 61,	111
Protozoa, Golgi Apparatus in	77
—, Role of, in the Activated Sludge Process, Further Studies on the ..	437
Protrellina phyllodromi sp. nov., A New Nematode Parasite of the Cockroach *Phyllodromia humbertiana* Sauss. ..	195
Psilotum triquetrum Sw., at Lonavala, Bombay Presidency	466
Public Health and Nutrition	415
Puccinia on *Chomelia asiatica* O. Kze., A New Species of	197
Puccinia droogenesis Butler on *Berberis aristata* D.C.	282
Pulsations of Variable Stars	269
Pyrethrum in Mosquito Control ..	378
Pyruvic Acid, Accumulation of, in Rice Moth Larvæ, fed on a Vitamin B, Deficient Diet	331
Quantitative Analysis, Intermediate (Rev.)	411
Quaternitions, Application of, to Relativity and Radiation Theory	213
Radio, You and Your (Rev.) ..	473
Radio Fade-outs in February and March 1942	185
Radiology Physics (Rev.)	340
Rainfall at Bangalore and Madras, A Note on the	364
— Frequency at Patiala	62
Ramalinga Reddy Sastyabdapurti Commemoration Volume: Part I ..	118
Raman Spectrum of Calcite, Crystal Orientation and the	100
— Spectra of 2-Hydroxy 4-Methoxy-Benzaldehyde	12
— — of Iodic Acid at Different Dilutions	101
Rats, Phenylhydrazine Anæmia in ..	360
Rectangular Plywood Containers ..	417
Reddy, Sir Chattamanchi Ramalinga, kt.	43
Reference Service and Bibliography (Rev.)	373
Relativity, General, The Equations of, Fit in	390
—, —, on a Lacuna in the Treatment of Internal Solutions in	391
Rhizophora mucronata Lam., False Polyembyony in Viviparous	242
Riccia, Three New Species of, from India	433
River Behaviour and Its Control ..	300
Rivers Indus, Sutlej, Ganges and Brahmaputra, Sources of the	351
Root-inducing Substances	122
Roy, Sarat Chandra (Obituary) ..	235
Royal Asiatic Society of Bengal ..	80
Saccharum officinarum and *S. arundinaceum*, Fungi on, Two New Reports of ..	150
Saliva coccinia Juss. ex Murr., Pink Coloured Mutant in	434
Salt Solutions, Some, Capillary Movement of, through the Black Cotton Soil, The Effect of Concentration on the ..	288
Satellite Thread, Translocation during Mitosis involving the, A Probable Case of	59
Science and Art	355
— and the World of To-day ..	1, 80
— and the World Mind	375
— in Everyday Life (Rev.)	292
Scientific and Industrial Research, Board of, Technical Work of the, A Brief Review of	171
— — — —, Hyderabad	124
— — —, Journal of .. 6	455
— Principles, Declaration of	46
Sclereids, Occurrence of, in the Leaf of *Olea dioica*	397
Seismological Notes 27, 81, 124, 167, 216, 259, 301, 345, 383, 417, 451,	481

	PAGE
Serratia sambharianus: A New Species from Salt Lake of Rajputana ..	107
Sesamum, S. orientale L. × *S. prostratum* Retz., An Interspecific Hybrid in	426
Seshiengar, M. (Obituary)	237
Shell-Fish, Fished by the Steam Trawler	16
Shellac Prices, Inflation of	477
Shells and Other Animal Remains found on the Madras Beach	117
"Sigcol" Glassware	81
Slaughter Houses, Our, The Organisation of	419
Smut Diseases of Wheat	78
Soap, Crystallisation of	13
Soil, Black Cotton, Vertical and Horizontal Shrinkage of, at Mandalay, Burma	364
Soils, Calcarious, Dispersion of, A Simple and Efficient Method for the	15
Soil Investigation in Sind	258
— Research and the Thungabhadra Project	164
Solar System, Origin of the	6
Solids, Expansion of, Coefficient of ..	430
Sorghum, Andropogon, Non-Heritable Polyembryoni in	241
Sources of the Rivers Indus, Sutlej, Ganges and Brahmaputra	351
Spectroscopy and Combustion Theory (Rev.)	473
Spectroscopic Investigation of the Solid and Liquid State	225
Spotless Sun for Two Days ..	300
Squilla larvæ from the Madras Plankton	56
Stars, Variable, Pulsations of	269
Statistical Conference, Indian, Baroda ..	75
— Methodology, Research and, The Second Year-Book of	115
Steels, Mild, Hot-Tinning of	299
—, Spark Testing of	416
Subsoil, Ill-Drained, The Effect of, on the Growth of Cotton and Groundnut	335
Sucrose, Clergets', in Sugar Products, Determination of, A Note on the Use of Potassium Chromate as the Deleading Agent in the	399
Sugarcane, Albinism in	402
—, Water Requirements of	164
—, and Its Hybrids, Chromosome Counts in the	194
— Breeding, More Parents for, Yet ..	150
— Wax 379,	450
Sugar Industry in India, 1939-40 ..	270
— Technologists' Association of India ..	260
Sulphanilamide in Monkey Malaria, Thiazole Derivatives of	187
— Group, Possible Lipophilic Chemotherapeuticals of the, Synthesis of ..	394
Sulphanilamides, N^1-Substituted Synthesis of	146
2-N^1-Sulphanilamido-4-*n*-*Propylthiazole*	103
Sulphur, Deposits of, in Baluchistan ..	256
Surgical and Orthopædic Instruments, Manufacture of	26
Symmetric Differences, The Method of, Tactical Configurations and ..	459
Synthetic Drugs, Manufacture of ..	47
Tartaric-Acid and Vanadic Acid, Mixtures of, Photo-Chemical Activity of, Studies on the	297
Teak Plantation, Pure, the Problem of the (Rev.)	374
Technical Mission, American .. 123,	144
Teeth, Successional Theory of, A Consideration of the	329
Technological Institute of North-Western University, Chicago, Establishment of	382
Temperature, Effect of, on the Dissociation of Strong Electrolytes by Raman Effect	429
Terrestrial Conditions, Solar Influence on	122
Textile Fibres in India, Some ..	35
Thungabhadra Project, Soil Research and the	164
Thyroglutus Malayus, Sex Dimorphism in	467
Timber for Aircraft	478
Timbers, Identification of	379
Tin, Emergency Economics in ..	415
— Research Report for 1941	416
Tinospora, Chromosome Number in ..	282
Torsional Vibration Problems, Practical Solution of (Rev.)	200
Tribolium confusum Duv., Effect of Fumigation on	164
Trichodesmium, The Alleged Inhibitory Influence of	406
Tuberculana	23
Tuberculosis Association of India 215,	257
— Number, Special, (*Indian Medical Gazette*, October 1942) (Rev.) ..	447
Tubers, Vitamins, Minerals, Carbohydrates and Proteins in	463
Tumors, Plant, Use of Colchicine in Preventing the Development of ..	415
Typhoid Fever, Suspected Cases of, Bacteriological Examination of Blood, Stools and Urine of	358
Ultracentrifuge, (A Simple), with Plastic Rotor	379
Ultra-Violet Rays, Chemical Action of (Rev.)	18
University of Calcutta .. 80,	345
— of Ceylon 301,	417
— of Delhi 259,	301
— of the Punjab	216
Vanda, Three Species of, Morphological Studies in	285
Vanguneria spinosa (N.O. Rubiaceæ), Seeds of, Fat from the	400
Vaporisation, Latent Heat of, Parachor and	461
Vegetable Fat, Hydrogenated, in the National Diet	298
— Insecticides in India	343
— Oils, Indian, Effect of Storage on ..	416
— Rubber in India, War-time Sources of	478
Venkatanaranappa, M. (Obituary) ..	236
Venkatesa Iyengar, Nangapuram (Obituary)	145
Venkatraman, Kt., Sir T. S.	5
Vibration Study, Fundamentals of (Rev.)	445
Vinegar from Sugarcane and Fruit Juices	451
Virus Diseases, Immunity Phenomenon in	34
Viscometry	254

	PAGE
Vitamin B, in Indian Foodstuffs, (Cereals, Millets and Pulses)	149
— C, Synthesis of, by Rice Moth larvæ (*Corcyra caphalonica* Staint.) ..	394
— D and Other Products of Metabolism from Yeast	189
Water Purification, Micro-Straining for ..	414
— in Soil, Upward Movement of, Darcy's Law and	430
Weirs in South India and their Effects on the Bionomics of the Hilsa in the South Indian Rivers—the Godavari, the Kistna and the Cauvery	398
Wood Preservation	344
X-Ray Investigations on Solids, Electrolytic Solutions ... Some Aspects of ..	31
— Reflections in Diamond	10
Yeast Protein, Nutritive Value of ..	476
Zoological Survey of India, Report on, for the Years 1938-41 (Rev.) ..	249

ERRATA

No. 2, February 1942, p. 81, in the table pertaining to Magnetic Notes: Under Quiet days, figure 18 has been omitted, and under Moderate days *for* 2 *read* 17.

No. 3, March 1942, p. 107, Fig. 3: *read* "hn" instead of "gn".

No. 6, June 1942, p. 242, in the legend below Fig. 1, *read* "right" for the word "left" within the brackets. In the right half of the page, line 3, the word "right" should be read as "left".

No. 8, August 1942, page 330, Note entitled "Arc Lines of Copper in Flame Spectra": *Add* the following before the present opening sentence:—

"In the course of an investigation which is in progress and a preliminary report about which has already been published on the study of the flame spectra of copper salts, we have found a few interesting points regarding the excitation of certain atomic lines of copper which it is our purpose to report in this note."

In line 9, *for* $3d^94s$ (3D) *read* $3d^94s$ (^{3}D). *Add* the following after the last sentence:—

"Full details regarding these and other features of the flame spectra will be published elsewhere; I also feel it a pleasure to thank Prof. Dr. R. K. Asundi for valuable discussion."

Page 334, Table Ib, under Moisture and Protein, the figures for Sode II and Golim should be as follows:—

74·80	19·41
75·30	19·60

and not

19·41	2·08
19·6	2·86.

No. 10, October 1942, page 393, first column, line 10, *for* "fall" *read* "rise".

Page 394, para 2, lines 13 and 14, *for* "2·4-4·0 mg.", *read* "0·24-0·40 mg."

No. 11, November 1942, page 423, para 3, line 8, *for* "useful References" *read* "Useful References". Para 5, line 14, *for* "Universal" *read* "universal". Para 6, line 4, *for* "semisolid", *read* "semi-solid". Para 8, line 2, *for* "Air Raids" *read* "air raids".

Page 424, para 1, line 3, *for* "into recipient", *read* "into a recipient"; line 8, *for* "nitrate", *read* "chloride". Para 9 *for "fluid must", read* "fluid must" (no italics). In the table, column 2, *for* "(= nothing small letter)", *read* "(= nothing, small letter)".

Page 425, in the List of Useful References, items (13) and (14), *delete* "(in press)", and *add* "1941".

Page 430, second column, line 1, *for* "$K = (4·68 \pm 5)$", *read* "$K = 4·68 \pm 0·5$".

Page 438, second column, regarding magnification of the photomicrographs, *for* "× 60", *read* "× 60, reduced to ½".

382-43—Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by B. N. Sastri, M.Sc., A.I.C., A.I.I.Sc., for the Board of Editors, "Current Science", Bangalore.

CURRENT SCIENCE

Vol. XI] JANUARY 1942 [No. 1

	Page
Science and the World of Today. D. V. G.	1
The Indian Journal of Genetics and Plant Breeding	4
Prof. C. R. Narayan Rao, M.A.	4
Sir T. S. Venkatraman, Kt., C.I.E., D.Sc., I.A.S.	5
Dewan Bahadur Dr. A. Lakshmanaswami Mudaliar	5
The Origin of the Solar System. By V. V. Narlikar	6
Letters to the Editor	10
Reviews	18
Centenaries—	
Halley, Edmund (1656-1742) ..	21
Fertility in Mammals and Birds. K. Subramanian	22
Science Notes and News	23
Academies and Societies	29
Supplement: Indian Science Congress, Baroda, 1942—Summaries of Addresses of the General President and Presidents of Sections	30

SCIENCE AND THE WORLD OF TODAY

ANOTHER article in this issue of *Current Science* deals with that part of Mr. D. N. Wadia's presidential address to the 29th Indian Science Congress (Baroda) which reviews certain aspects of the geological structure of India. This note is intended to consider some general remarks made by him on the now much-discussed subject of the relation between science and the world of today. He enters a protest against the suspicion and uneasiness expressed of late by some no doubt well-meaning people about the growing power of science. In this timely protest, Mr. Wadia has voiced the feeling not only of scientists in general, but of all men of cultivated intelligence and just sensibility to benefits received. All alike will share his hope that "science will, without doubt, re-build the damaged world on better foundations and reintegrate the stricken people to a new and more secure life". To cherish such a hope is, however, to admit the social responsibility of the scientist; and if that social responsibility is admitted by the scientist, he cannot consistently repudiate the charge that till now science has gone on in forgetfulness of that responsibility; for if science had remembered that responsibility and taken thought as to ways of implementing it, we should not have had to witness the present wreckage of civilization. The difference between the present war and the wars of antiquity, in magnitude and in incidence of destructiveness, is the difference made by the progress of science. If science may claim, as Mr. Wadia claims on its behalf, credit for having conquered "many plagues and diseases" and "probing truths about creation," she must just as well be

prepared to take the blame that belongs to the discovery of fire-bombers and poison gas. Among her children are both angels and their opposites.

It is no use trying to plead that the scientist is innocent and lay the blame exclusively at the doors of the politician and the manufacturer. These no doubt have their share in this organization of disaster. But they have equally a share in science's record of regenerative service to mankind. What can be legitimately claimed for the scientist is that he has had no share in the profits reaped by the manufacturer or the applause elicited by the war-minister, and that he had no personal interest to promote. This plea, however, can be of no avail to him against the charge of negligence and want of wakefulness. Nobody would think of accusing the scientist of homicidal designs; but at the same time nobody could help thinking that, in not taking heed about the dangerous potentialities of his handiwork, he betrayed a singular lack of appreciation of his responsibility as a social being. In purest innocence, but equally in surest thoughtlessness, he helped to upset humanity's apple-cart. The lesson for him today is that he should beware of jingo-politicians and greedy merchants. Mr. Wadia is on the hopeful track when he speaks of "the democracy of science and altruistic knowledge" and suggests an international directorate of scientists as a means of preventing the abuse of science.

But it is not clear that in his plan of an international directorate, there will be a place for politicians. He indeed appears to think that "chancellors, diplomats and politicians" have had a long enough chance and must now be put aside. This is rather an unscientific judgement for a scientist to pass on fellow-labourers of another category. The root cause of war is in the organization of unsatisfied human hungers and the counter-organization of fears and greeds which it provokes. The righteous politician endeavours to regulate the hungers, and the unrighteous one to excite and extend them. But neither creates the hunger, nor can either abolish it altogether; nor can the man of science either. The politician in any case has to reckon with it; and he has the duty of making a "science" of his job too to the extent possible. Our trouble of today is the outcome of the long-existing aloofness between the so-called natural sciences on the one side and the social sciences on the other; between the exact knowledge of the external world on the one side and the hints and guesses of man's internal world on the other side; between physics and chemistry and biology and the like on the one side and psychology and religion and economics and politics on the other side. Sir V. T. Krishnamachari (Dewan of Baroda), as was only to be expected of him, spoke like one who has observed life and pondered over its problems from many points of view when, in his speech welcoming the Science Congress, he said:—

> The evil thus calls for not less of science but more of science—science in the broadest sense of the word, embracing the social sciences, those dealing with human relations—and also philosophy—all working with a common aim and a sense of unity and viewing life as a whole. Only thus can civilization be re-shaped so as to enable human personality to reach the fullest development of which it is capable.

What can save mankind is the cultivation of a unified and synoptic view of life,—a philosophy of world management in which

the sciences and the arts,—the achievements of the laboratory and the appeals of the music hall and the theatre, the findings of statistics and the messages of literature,—are all brought into correlation in the service of a large and upward-looking humanism. It is for such a synthesis that the world is waiting. A corollary to this belief is that science should refuse to be controlled by narrownesses of geography and race miscalled patriotism and nationalism. Science should commit its achievements to the care and management of a truly international agency which can be trusted to function with every conscientious care for the welfare of the whole of mankind and in no partiality or favouritism for any section or division of it. Patents and monopolies must be destroyed; and all that is of value and significance should become available to the public of the entire international world. This is a condition of minimising the evil possibilities inherent in the possession of lethal secrets.

In speaking of the philosophical achievement of science, Mr. Wadia has used language which does not quite accord with the attitude of modesty proper to science. He says that "science is near making an approach to Absolute Truth". How near?—one may ask; for, measurement implies precise knowledge of the two ends of the road. Has any one a fore-knowledge of what absolute truth is and how the distance between that truth and ourselves is to be measured? Many are the pilgrims that fancy themselves to be on the road to the shrine of absolute truth. Metaphysics, poetry, art—these too have been endeavouring to capture a vision of the reality behind the phenomena of the universe. Here, as in the effort to secure world-peace, there is no warrant for the hope that the prize is for the soloist, whether he be scientist or poet or man of religion. True vision is to be hoped for only from the focussing of rays from all quarters from which light may shine. The several rays will serve both to correct and to supplement one another.

Indeed, is science unitary? Is it not still in a state of flux? Are its many branches speaking with one voice? With the progress of research and the increase of the armies of researchers, ramifications of science have become so many, and specialism has gone so far afield along every line, that anything like a unified and consistent message of science as a whole as to the principle of Nature and the meaning of life seems at the present stage to be impossible to arrive at. While some of the many mouths of science are speaking more or less clearly and others are just making inarticulate sounds, there are others that have not become even vocal yet. Until science has come to speak in one final voice, it is best she should have the candour to say that her final answer is not ready yet to the ultimate questions of life and reality. Perhaps it is inevitable that science should for ever remain as various in her speech as Nature appears to be in her plans,—as various in its findings, as tentative, as wanting in definitiveness on questions pertaining to that which (if it exists) transcends all the shapes and forms and forces of Nature. If this position is accepted by the scientist, it would be a contribution of some real value to the needed philosophy of life. Elimination of exaggeration is also a step taken towards Truth.

D. V. G.

THE INDIAN JOURNAL OF GENETICS AND PLANT BREEDING

THIS is a welcome addition to the ranks of Indian scientific journals. It is the official publication of the Indian Society of Genetics and Plant Breeding. New scientific societies intended to follow up different branches of science are "a natural phenomenon and often connote vitality and survival value". The Indian continent is rich in crops and domesticated animals and has many centres for their breeding. The Journal should therefore have plenty of data and experience to record. It is hoped that the linking of Genetics to Plant Breeding will result in the creative development of better crops and animals, through superior germ plasm. We wish this new Journal a career of prosperity and usefulness.

PROF. C. R. NARAYAN RAO, M.A.

FRIENDS of *Current Science* will learn with regret that PROF. C. R. NARAYAN RAO, who has been the Chief Editor since

its inception in July 1932, has retired from the Editorial Board, as from the 11th of this month. The world will never know the great many services he has rendered to the Journal and the very many critical phases of development through which the Journal has been successfully piloted by him. After his retirement from the Mysore University Service in 1937, he continued to devote himself to the work of the Journal and the greatest and the most enduring contribution which Prof. Narayan Rao has made to the advancement of *Current Science* is the organization of a band of young and devoted enthusiasts who, out of pure love of the cause, have given freely of their time and labour for the service of the Journal under his inspiring guidance.

In December 1938, he undertook an all-India tour at great personal sacrifice and visited many of the university centres and the capitals of Indian States in Western and Northern India as the envoy of *Current Science* pleading for increased financial support; the response has been both spontaneous and generous. Prof. Narayan Rao may well feel proud of the high prestige which the Journal now commands in the field of international science. We have every hope that he will continue to evince the same keen interest in the progress of the Journal. All friends of *Current Science* will join with us in wishing him long life and unalloyed happiness in his retirement.

SIR T. S. VENKATRAMAN, Kt., C.I.E., D.Sc., I.A.S.

WE wish to extend our hearty felicitations to Sir S. Venkatraman of Tiruvadi, C.I.E., D.Sc., I.A.S., on the occasion of the

conferment of the Order of Knight-Bachelor by His Majesty the King-Emperor, in the New Year Honours' List. This distinction is a belated recognition of his invaluable and brilliant scientific contributions to the development of the sugarcane production covering a period of more than 30 years. The Sugarcane Breeding Station at Coimbatore will ever remain a monument to his devoted labours and constitutes the very foundation on which the present prosperity of the Indian sugar industry rests. The breeding work carried out by Sir Venkatraman—aided by ample tariff protection—has been responsible for converting India from an importer of white sugar (1 million tons) to a position where the future of the Indian industry is in urgent need of securing export markets. It has been computed that the work has resulted in a conservation of about 15 crores of rupees in the country besides the obvious advantages which a prosperous industry necessarily brings to the cultivator and the manufacturer. These were denied to this impoverished country for at least half a century. We wish Sir Venkatraman many many years of greater achievement in his scientific field and many a higher distinction to crown his labours.

DEWAN BAHADUR DR. A. LAKSHMANASWAMI MUDALIAR

IT is with great pleasure that we announce that Dr. A. Lakshmanaswami Mudaliar, Principal, Madras Medical College, has received the distinction of the Fellowship of the American College of Gynæcological Surgeons. He is the first Indian to receive this honour. Dr. Mudaliar enjoys the reputation of being one of the foremost Obstetricians and Gynæcologists of the day. In 1930 he was elected a Foundation Fellow of the British College of Obstetricians and Gynæcologists in England. His contributions to the development of this vital part of medical science, are well known and widely recognised.

Dr. Mudaliar, as member of the Syndicate of the Madras University, as the member of the Medical Council of India, as member of the Indian Research Fund Association and as the University representative on the Council of the Indian Institute of Science, has advanced the cause of higher medical education and medical research in this country. *Current Science* is fortunate in having Dr. Mudaliar as one of its staunchest supporters. The Government of India have decorated him with the title of Dewan Bahadur in recognition of his services.

We wish to offer Dr. Mudaliar our hearty felicitations on the distinctions conferred upon him.

THE ORIGIN OF THE SOLAR SYSTEM

BY

V. V. NARLIKAR

(*Benares Hindu University*)

THE problem of the origin of the solar system has defied all attempts at solution and it has been, for over a century, an outstanding challenge to mathematicians. Once it was considered to be essentially a hydrodynamical problem and it inspired a series of researches by Tchebycheff, Liapounoff, (Sir George) Darwin, Poincare, Jeans and others. With the accumulation of data the centre of enquiry shifted to the dynamical features of the system. And now, with our knowledge of the internal constitution of stars, we find the problem much more complicated than what it was originally understood to be.

What do We mean by the Solar System?

The solar system consists of the day star, that is, the sun, nine major planets with their twenty-eight satellites, over fifteen hundred planetoids and thousands of comets, not to mention the countless meteors and meteorites that cross the earth's way in the skies. The satellites move about their respective planets and the planets, planetoids and comets about the sun. The sun itself moves with the velocity, 300 km. sec.$^{-1}$, relative to the centre of the galaxy.[16] But we are not concerned here with the solar motion as the system is practically isolated from the rest of the universe. Light does not take more than a few hours to go from one end of the solar system to another while the journey from the nearest star to the sun is a matter of no less than four years. The most striking feature of the isolated system is that while most of the matter is concentrated in the sun, most of the motion is associated with the rest. The solar mass is 744 times the mass of the rest although the sun's share of the total angular momentum of the system is hardly three per cent. It is also noteworthy that the central body, the sun, is self-luminous while the planets and satellites which represent practically all the matter and angular momentum of the rest, are opaque bodies reflecting the solar light. By the solar system we mean therefore a luminous mass, a star, surrounded by dark bodies, much smaller in weight, moving fast enough to make the distribution of matter and motion extremely uneven as stated above.

Is There in the Whole Universe only One System Like the Solar System?

The tower of observation rises high above the mansion of theory. Whenever, therefore, observation gives one answer to a scientific question and theory another, the former is regarded as right and the latter indisputably wrong. Suppose that the nearest star,[14] Wolf 424 (?), possesses a planetary system like ours. Can the planets at that distance from us be visible at all on the earth? Russell[15] replies in the negative adding that they won't be visible through the most powerful telescope that we have or that we can construct. Observation cannot therefore provide a decisive answer to the question mooted above. Recourse is now had to theory and we stalk the question by enquiring how a system such as the solar system could originate in a primitive world of stars and nebulæ. If we trace the history of the solar system backward, along the lines of evolution, we may arrive, at a fairly distant epoch, at diverse sets of plausible circumstances in which case we will conclude that there are many such systems in the universe. If, however, the circumstances as demanded by the theory at that epoch are highly improbable, in the then state of the world, the solar system will be regarded a freak of nature.

The matter is not however so simple. As E. W. Brown[1] has shown it is not possible to trace the evolution backward beyond a hundred million years without applying the complicated relativistic correction. According to the theory of space and time to which we are committed by our knowledge of gravitational and world situations a small primeval universe of matter became unstable and broke up into stars and nebulæ some two thousand million years ago. Moreover, the geologist puts the age of the earth at several thousand million years on the evidence of uranium, thorium, helium

and lead in rocks. So we cannot ignore the relativistic correction in the treatment of the evolution of the system. It is required that on no account must theory outrun the limits of observation. If it is impossible to settle by observation whether there is only one solar system or more theory must give an equally ambiguous decision about the probability of the genesis of a planetary system in a world of stars and nebulæ. The failure of the theoretical investigation is, therefore, a foregone conclusion. In non-trivial mathematics we reach a substratum of propositions that cannot be demonstrated, which are couched in terms that cannot be defined. Similarly, an investigation of trivial mathematics rests on some assumption that cannot be justified, which relates to circumstances that are never fully understood. It has been seriously suggested by some that the stars, the nebulæ and the planetary systems (one or many that there are) must have all come into existence about the same time. This suggestion merely drives the required explanation further away into the unknown and the investigator who accepts it finds himself in a blind alley. An obvious implication of the suggestion is that the cosmic upheaval which was responsible for the genesis of millions of stars and nebulæ might have produced numerous solar systems also.

The theoretical worker cannot visualize the detailed processes in the world catastrophe leading to the creation of stars, nebulæ or the solar system. Under these circumstances it appears more probable that many systems possessing the two patent characteristics of the solar system were created. These are first thoughts; a closer scrutiny of the system reveals a number of regular features which deserve to be noted here.[6] (1) Most of the matter outside the sun in the system is shared by the major planets all of which move practically in the same plane. (2) The solar axis of spin is nearly perpendicular to this plane. (3) Most planets and a majority of the satellites spin in the same sense as the sun, there being only nine or ten satellites with retrograde motion.[2] (4) The satellite systems of Jupiter and Saturn are miniature models of the solar system, the nearer satellites moving in the neighbourhood of the equatorial plane of the central planet. (5) The orbits of most of the planets are nearly circular. (6) The mean distances of the planets from the sun and of the satellites from the corresponding central planets follow a simple empirical law which is a generalization of Bode's law.[13] All these regularities are not just an aftergrowth achieved in the long period of evolution after the genesis of the system. The problem of the origin of the solar system is really to infer how these and other regular features came into being and developed. The hypothesis of a world catastrophe does not help us to solve the problem.

As we will presently see other theoretical lines of investigation are possible. Whatever answer they provide to the question under consideration will attain the status of a theoretical speculation only. This is due to our inability to settle the question by observation. In spite of this the theoretical study of the problem is vigorously pursued because, evidently, "the pursuit of truth is more precious to man than truth itself".

Those who reject the theory of a world catastrophe start with the assumption that the planets are the offspring of a star. Modern spectroscopic and geological research supports this assumption. The theories that are built upon this basis are not less objectionable than that of the world catastrophe. But they have one distinguishing characteristic which is that they make the birth of planets a very rare phenomenon. Thus neither theory nor observation can satisfactorily settle whether the solar system is a common or an uncommon feature of the universe.

Is the Sun the Parent Body?

Having decided to explore the possibility of the planets being born of a star one would examine whether the sun itself is not the parent body. Luyten,[7, 8, 9] who has considered the question very thoroughly believes even to-day, on account of the regular features of the solar system, that no extraneous disturbing agent was responsible for its origin. This probably means that according to him, the sun is the parent body. Babinet's calculations[3] of 1861, revised in later years by others, definitely show that a star having the mass and the angular momentum of the solar system and the density of the sun cannot break up through instability. The ruling conceptions about the internal constitution of stars and their energy generation do not warrant that a G-type dwarf like the sun was ever a variable star or a nova

or thermodynamically unstable in any way, at any time, in the past. Even if we concede the possibility that the sun was unstable once it will still require proof that its fission has led to the planetary system with all its features. The simpler problem about the origin of binary stars has not yet been solved in this way and experts are of the opinion that fission may have nothing to do with it. Even in the matter of the earth-moon system the idea of fission was finally abandoned, about twelve years back. The prevalent view is that mere mechanical or thermodynamical instability in the sun, in the absence of an outer influence, could not be a sufficiently effective agent for the genesis of the planets. Apart from that, even if a break-up occurred, as suggested, it is difficult to see how planets with their shapes, sizes, momenta and orbits were formed in this manner.

Attempts have been made to explain the formation of planets out of the solar material under the gravitational influence of a visiting star. There is the American theory of Chamberlin and Moulton which has been ignored in Great Britain and there is the British theory of Jeans and Jeffreys which has been ignored in America. While the two theories differ in their descriptive contents, in all essential respects and in all crucial matters, both have many identical weaknesses and fail equally miserably. Granted that matter is pulled out of the sun under the attraction of the visiting star we cannot decide whether the encounter should be too close or fairly distant. For unless the encounter is sufficiently distant the planets formed out of the ribbon of matter stretching from the sun to the star cannot have the large angular momentum per ton that they have. On the contrary, it seems that unless the encounter is very close sufficient matter cannot impinge upon the condensing planets to give them the required spin about the axis. These conflicting demands of the theories have rendered them invalid although the formation of a ribbon is suggested by the order of sizes and masses of the planets and their numbers of satellites from Mercury to Pluto. There is an additional difficulty also regarding the condensation of the material in the ribbon into planets. At the high stellar temperatures, it is not at all clear, how the hydrogen of the ribbon failed to escape from the weak forces of gravitation and how the condensations were formed.[8,12] But then probably the very smallness of mass of the planets suggests that a good deal of the material escaped in the process of condensation. It is argued that hydrogen may have been reacquired later by accretion.

Thus it appeared that the formation of a ribbon was an essential stage in the genesis of the planets. It became also evident that a collision of the type envisaged by Jeans, Moulton or Jeffreys[4] was not responsible for the ribbon. So now arose the theory of Russell and Lyttleton[9] that the parent-body of the planets was some other star, out of which a ribbon was drawn by a very massive star in a near collision and that the sun, which happened to be in the neighbourhood, captured most of the material of the ribbon.

Lyttleton's Theory

Lyttleton has to consider the three-body situation of the gravitational problem. Following Jeffreys he admits explicitly that, as precise details could not be given, he has confined himself only to the orders of magnitudes. He uses the three integrals of energy, momentum and angular momentum and considers a redistribution of the quantities as a result of the encounter without violating the principles of conservation. It is nowhere proved that such a redistribution is actually permitted by the equations of motion. The circumstances[8] under which the redistribution as devised would actually occur are not known. It[11, 12] is so arranged that the very massive star (of mass $8\odot$) collides with a star heavier than the sun (of mass $2\odot$) and snatches it away under its gravitational attraction. The sun is supposed to be sufficiently away from the scene of action so as not to be captured by the massive star. But it happens to be sufficiently near also to attract portions of the ribbon on which the gravitational actions of the others are balanced. It is argued, to make the situation more plausible, that the sun was a double star and that the companion, which was more massive, was enticed away by a visiting star. The planetary system is the relic of this encounter. This was described as 'the enticement theory' of the Solar system by Knox-Shaw.

This theory has many features of an unsatisfactory nature. That the visiting star should be moving in the plane of the binary,

that its mass should be 8⊙ or more while that of the sun's companion is about 2⊙, that the sun should be very favourably situated to gain large chunks of the ribbon without falling into the gravitational trap of the visitor, that the ribbon should condense into planets with a large supply of hydrogen when all hydrogen is expected to escape, at the high stellar temperature, on account of the smallness of the gravitational attraction—all these make one feel that if the theory is right, "the solar system has narrowly escaped not coming into existence".[5] Lyttleton's energy manipulations require the visiting star to be one like Capella A. Such stars appear to be very rare in space and they are not the right sort, on account of the low density, for getting considerable matter (·05⊙) into the ribbon. Luyten[7] has, therefore, described this theory as 'astrophysically objectionable', 'dynamically untenable' and 'superlatively improbable'. We cannot say that it is dynamically untenable. But we believe that the onus is on the author to show under what circumstances it is tenable. Lyttleton has expressly avoided this, as the task undertaken by him is just to show that a solution on these lines exists.

Are we to reject Lyttleton's theory because the circumstances of the collision are highly improbable? We are not inclined to do so until another solution is in sight. But let us see what the solution offered by this theory means. Our original problem was to account for the curious regularities of the solar system. Some of them we have been able to trace to certain unusual circumstances of the origin of the system. The mysterious element has not been removed as a result of our enquiry; only its centre of gravity has been shifted. It must be admitted that when the enquiry was started by Kant or Laplace the object was to trace all the mysterious elements of the situation to general laws and unexceptional initial conditions. Apart from all this, we find that the theory is not applicable to the satellite systems of Jupiter and Saturn. Intrinsically there is nothing wrong in assuming similar exceptional circumstances to prevail for the genesis of these systems. Once we have decided to entertain the 'mystic' element in our explanations, they are not hard to discover.

What Next?

It looks as if the scientist has been blundering along like Dr. Watson in this investigation. We want a Sherlock Holmes to enter upon the scene. Probably he has been there already. But he has not yet discovered his patent clue, 'the cigarette ash', which may be anything in this about meteorites, planetoids, retrograde satellites, stars or even the comets that are so different in every way from the planets. Who knows? We may have to solve the problem of the double stars first. Our knowledge on the various astronomical fronts has advanced so rapidly in the last ten years and so many of our scientific views have been upset that the much needed clue may be found in a strange form and in an unexpected quarter. Until that happens we have to examine every bit of evidence at our disposal, by itself, and in all possible situations that are relevant.

---

[1] Brown, E. W., *U. S. Nat. Res. Council*, 1931, Bulletin 80, Part 5.

[2] Hunter, A., *Science Progress*, 1939, **33**, 760.

[3] Jeans, Sir J. H., *Astronomy and Cosmogony*, 1929, p. 395.

[4] Jeffreys, H., *M. N. R. A. S.*, 1932, **92**, 890.

[5] Jones, H. S., *Life on Other Worlds*, 1940, 234.

[6] Luyten, W. J., *Observatory*, 1938, **61**, 83.

[7] —, *Ibid.*, 1940, **63**, 72.

[8] —, *M. N. R. A. S.*, 1939, **99**, 692.

[9] Lyttleton, R. A., *Ibid.*, 1936, **96**, 559.

[10] —, *Ibid.*, 1938, **98**, 356.

[11] —, *Ibid.*, 1940, **100**, 546.

[12] —, *Observatory*, 1940, **63**, 206.

[13] Narlikar, V. V., *Phil. Mag.*, 1931, **12**, 67.

[14] *Observatory*, 1938, **61**, 167.

[15] Russell, H. N., *The Origin of the Solar System*, 1935, p. 3.

[16] Smart, W. M., *Stellar Dynamics*, 1938, p. 369.

LETTERS TO THE EDITOR

	Page
Raman X-ray Reflections in Diamond. By P. R. Pisharoty	10
Adsorption and Display of Colours. By Kittur Subba Rao	11
Raman Spectra of 2-Hydroxy 4-Methoxy-Benzaldehyde. By M. Seshaiyengar	12
Effect of Common Ion on the Electrolytic Dissociation of some Strong Electrolytes. By N. Rajeswara Rao	13
Crystallisation of Soap. By S. R. Palit	13
A Simple and Efficient Method for the Dispersion of Calcareous Soils. By (Miss) G. Sharada Bai, K. S. Gururaja Doss and Basrur Sanjiva Rao	15
A Cheap Substitute for Amyl Alcohol used in the Determination of Fat in Milk. By K. Swaminathan	16
Shell-fish Fished by the Steam Trawler "Lady Goschen". By D. W. Devanesen	16

RAMAN X-RAY REFLECTIONS IN DIAMOND

The work of Sir C. V. Raman and his collaborators has definitely shown that the second kind of monochromatic X-ray reflections given by the lattice planes of a crystal represent the X-ray analogue of the well-known Raman effect observed in light scattering. The appearance of these Raman reflections from the (111) planes of a diamond crystal belonging to the normal variety were discussed theoretically by the present writer in a previous paper.[1] The conclusions of that paper are in complete agreement with the observations of Raman and Nilakantan made in this laboratory and also those of Lonsdale and Smith[2] made at the Royal Institution.

In a recent letter[3] to *Science and Culture* Sirkar and Bishui have raised a few points regarding that theory. They believe that the assumption of the existence of continuously varying *long* wave-lengths for the infra-red vibrations of the crystal lattice is inadmissible. However, if one remembers that the strong coupling between the various atoms of a diamond lattice would prevent any appreciable variation of phase between the oscillations of two neighbouring cells, it is easy to realise the necessity of the phase wave-lengths of the oscillations being *very large* compared to the lattice spacing.

Another point raised by these authors is that the theoretically predicted symmetrical cross, with the Bragg reflection at its middle for the setting $\theta_i = \theta_h$ is absent with some specimens. The accompanying picture taken by Dr. Nilakantan before the publication of the theory shows the cross clearly. The intense photographic halation at the correct Bragg setting has necessitated a considerable reduction in the exposure so that the full length of the streamers is not recorded. The absence of these

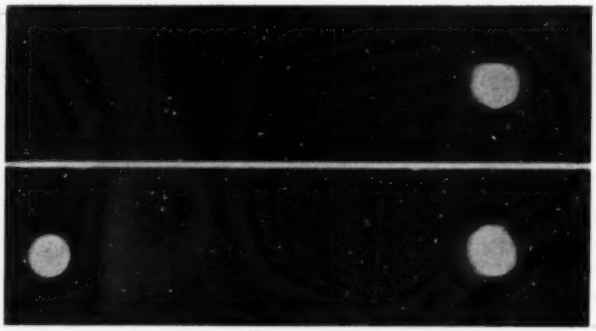


Fig. 1

subsidiary phenomena in the rare type of diamond has been explained by the present

writer and Subrahmanian[4] to be due to its mosaic structure and the consequent lack of co-operation between the lattice planes of the different mosaic blocks.

Thirdly Sirkar and Bishui report that the Raman reflection for the setting $\theta_i < \theta_B$ appears as a diffuse triangular spot with its apex towards the Laue spot and not circular as required by the theory. The five pictures published in the *Proc. Ind. Acad. Sci.*, A, Vol. XIV, Plate XVII, Figs. 5 g, h, i, j, k show the circular spots demanded by the theory.

The original and later theories of Zachariasen[5, 6] give half-breadths for these Raman reflections which should be of order of the missetting ($\theta_i \sim \theta_B$) when this is more than 1 or 2°. The accompanying pictures are taken with a narrow slit 0·2 mm. wide, 5 mm. high and 130 mm. deep and a diamond plate 4 mm. × 7 mm. × 0·76 mm. The Raman reflections take place from the (111) plane of the crystal, ($\theta_i - \theta_B$) being + 4°42′ and + 1°35′ for the two figures (*a*) and (*b*) respectively.

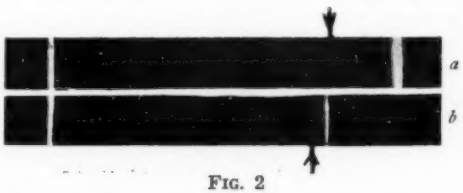


FIG. 2

The sharpness of the reflections clearly shows how Zachariasen's theories are totally inadequate to explain the facts.

The sharpness of these Raman reflections has been emphasised by the Royal Institution workers also.[7] But they avoid the inevitable conclusion as to the specular character of the new phenomenon by calling these reflections as "secondary phenomena", on the basis that they are absent in mosaic crystals of diamond, in spite of the fact that these Raman reflections are far more intense than the weak diffuse effect they have observed and which they prefer to call the 'primary'. The absence of the Raman reflections in the mosaic type of diamond simply shows the very high degree of coherence necessary between the secondary radiations from the various individual atoms to make the new phenomenon observable with crystals having large binding forces.

The diffuse effect itself can be accounted for as due to the super-lattice oscillations described and employed in a recent symposium on the Thermal Energy of Crystalline Solids.[8]

Details of this will be published later.

P. R. PISHAROTY.

Department of Physics,
Indian Institute of Science,
Bangalore,
January 16, 1942.

---

[1] Pisharoty, *Proc. Ind. Acad. Sci.*, 1941, **14**, 56.

[2] Lonsdale and Smith, *Proc. Roy. Soc., Lond.*, 1941, **179**, 8.

[3] Sirkar and Bishni, *Sci. and Culture*, 1941, **7**, 314.

[4] Pisharoty and Subrahmanian, *Proc. Ind. Acad. Sci.*, 1941, **14**, 439.

[5] Zachariasen, *Phys. Rev.*, 1940, **57**, 597.

[6] —, *Ibid.*, 1941, **59**, 860.

[7] Lonsdale and Smith, *Nature*, 1941, **148**, 112 and *Phys. Rev.*, 1941, **60**, 617.

[8] Raman, Norris, Anand, Dayal, Venkateswaran, *Proc. Ind. Acad. Sci.*, 1941, **14**, 459–515.

ADSORPTION AND DISPLAY OF COLOURS

WHEN activated alumina gel is dropped into a mixture of benzene and carbon tetrachloride, the white gel becomes jet black, whereas with either benzene or carbon tetrachloride, the gel develops no such colour. This extremely interesting phenomenon, briefly indicated in a former communication,[1] is found to be of a general character, as revealed by further investigations.

Sulphate in alumina has an important role in this effect. Alumina gel[1] prepared from aluminium sulphate was found to contain some sulphate in it, in spite of prolonged washing. Such a gel, after activation, always showed the colour effect. Gel prepared from aluminium nitrate showed not a trace of the colour. On soaking the above gel in ammonium sulphate

solution and subsequent heating for a short time, to activate it, the colour effect with benzene and carbon tetrachloride mixture was displayed. The gel containing sulphate was strongly ignited to decompose the sulphate. The ignited gel produced no colour. So it is definite that sulphate in alumina has an important role in producing the black colour.

In place of carbon tetrachloride in the mixture several halogen derivatives, such as (1) Methylene chloride, (2) Chloroform, (3) Tetrachlorethene, (4) Chlorobenzene, (5) Benzyl chloride, (6) Bromoform, (7) Ethylene dibromide, (8) Bromobenzene were used in combination with benzene. A mixture containing benzene and a halogen derivative would always show the colour effect. Having a trace of green or violet in some cases, the colours in different mixtures slightly differed from one another. The effect is of a general character, in being produced always in a mixture containing an aromatic nucleus and a halogen derivative.

The development of colour is gradual. The activated opaque gel on being dropped into benzene and carbon tetrachloride mixture first becomes yellow which changes over to orange red, greenish brown and finally black.

When the blackened gel is dropped into water the colour disappears. This is obviously due to the preferential adsorption of water by the gel surface. After treatment with water, the gel is white as before and the supernatant liquid colourless.

The mechanism of the development and the display of the colours is probably the formation of an adsorption complex and a precursor to the well-known Friedel and Crafts' reaction.

It is known that the characteristic absorption, of an aromatic compound shifts, on halogenation of the nucleus, from the ultra-violet towards the visible. This is probably a case of loading of the aromatic nucleus with halogen,[2] brought about by alumina-sulphate. A study of the absorption spectra of the system at various stages of development of this colour effect may throw light on the nature of this interesting phenomenon. Investigations on this line are in progress.

KITTUR SUBBA RAO.

Department of Chemistry,
Central College,
Bangalore,
December 12, 1941.

---

[1] Rao, K. S., and Rao, B. S., *Proc. Ind. Acad. Sci.*, 1936, **4**, 562.

[2] Suggestion by Sir C. V. Raman in a private discussion.

RAMAN SPECTRA OF 2-HYDROXY 4-METHOXY-BENZALDEHYDE

THE above substance was isolated as a white solid from the roots of *Decalepis Hamiltonii* (Kannada name, *Makaliberu*).[1] It consists of colourless rectangular platy crystals belonging to the monoclinic system.

As 4-methoxy-β-resorcylaldehyde is highly soluble both in carbon tetrachloride and glacial acetic acid, a study of its Raman spectra has also been attempted. The solutions however turn yellow after a time and the consequent absorption of the HgI λ4358 A° decreases the efficiency of this radiation in producing Raman lines. Long exposures have however revealed two faint Raman lines at 1655(4) and 1215(3) cm.$^{-1}$ in a 30 per cent. solution of the substance in carbon tetrachloride. The solution in glacial acetic acid showed a few more lines (even fainter) with frequency shifts of 280(1), 340(1), 715(0), 820(0), 1345(1), 1450(1) and 3300(2) cm.$^{-1}$ The lines observed in carbon tetrachloride solution appeared stronger. As the light gathering power of spectrograph employed is small, and the solution is coloured, the Raman frequencies of the substance are, it is felt, necessarily incomplete. The substance exhibits a weak fluorescence in consequence of which the Raman lines are superposed on a continuous background which extends from longer wave-lengths right up to about 800 cm.$^{-1}$ from λ4358 A°.

I wish to acknowledge with thanks the help given to me by Dr. L. Sibaiya in the spectroscopic portion of the work.

M. SESHAIYENGAR.

Intermediate College,
Bangalore,
December 8, 1941.

---

[1] Srinivasa Rao and Sesha Iyengar, *Perf. Essent. Oil. Rec.*, 1923, **14**, 300.

EFFECT OF COMMON ION ON THE ELECTROLYTIC DISSOCIATION OF SOME STRONG ELECTROLYTES

DURING the course of investigations on the electrolytic dissociation by the mechanism of Raman effect, a study of solutions of strong electrolytes as influenced by the addition of some other strong electrolytes with a common ion has revealed the following phenomena.

1. The variations in the intensity of the 1045 line characteristic of HSO'_4 ions indicate that the degree of dissociation of sulphuric acid diminishes by the addition of other acids, which supply H^+ ions in abundance, *e.g.*, $HClO_4$ and HCl.

2. The variations in the intensity of the 1300 line arising out of the undissociated HNO_3 molecules show that the dissociation of nitric acid is suppressed by the addition of other acids, *e.g.*, $HClO_4$, H_2SO_4 and HIO_3.

3. The dissociation of HSO'_4 ions into H^+ and SO''_4 ions in a solution of a bisulphate, *e.g.*, NH_4HSO_4 is also found to decrease by the addition of HCl.

In all the above cases, the dissociation is diminished by increasing the proportion of the H^+ ions.

1. The dissociation of HNO_3 is found to increase by the NO'_3 ions supplied by NH_4NO_3.

2. The dissociation of HSO'_4 into SO''_4 and H^+ ions in a solution of a bisulphate is found to increase with the addition of SO''_4 ion supplied by a sulphate. This is tested in the case of mixtures of $NH_4HSO_4 + (NH_4)_2SO_4$, $KHSO_4 + (NH_4)_2SO_4$ and $NH_4HSO_4 + Li_2SO_4$.

It appears from the above results that while the behaviour of the additional H^+ ions is in conformity with the law of mass action, the anion gives results just opposed to this law. It is well known that the law of mass action does not hold for concentrated solutions of strong electrolytes, as the constant is found to vary with concentration. But, the result entirely opposed to the law obtained with the addition of the anion was never contemplated before.

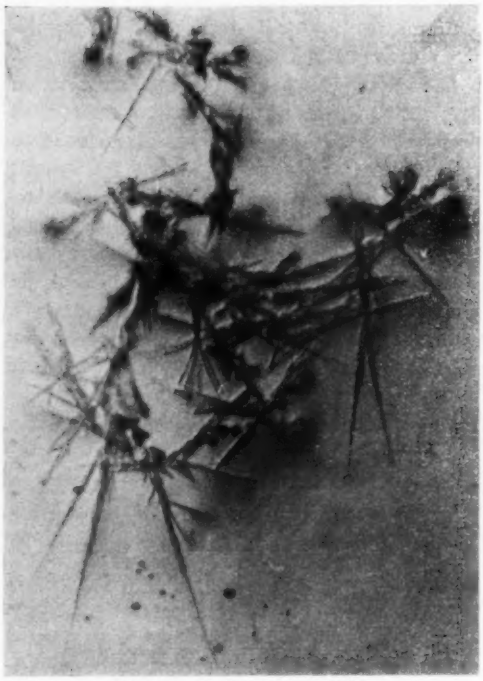
Further work with other electrolytes is in progress to permit of a generalisation as to the applicability of the law of mass action to strong electrolytes.

N. RAJESWARA RAO.

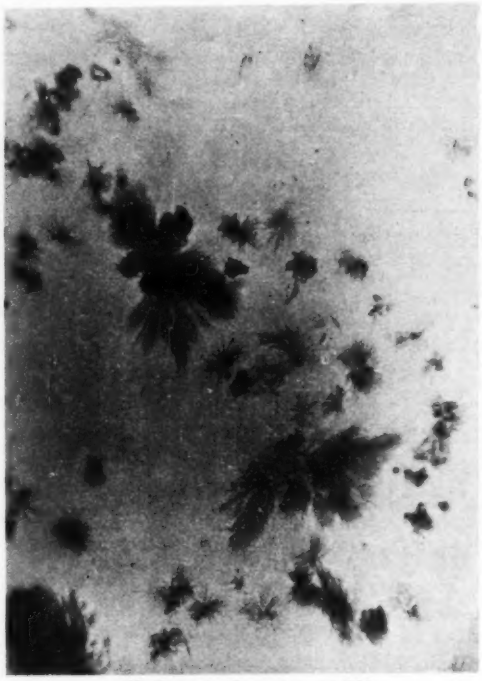
Andhra University,
Waltair,
December 29, 1941.

CRYSTALLISATION OF SOAP

IT is extremely difficult to produce crystals of alkali metal soaps (sodium palmitate, sodium stearate, etc.), though sometimes a very small amount is found to have spontaneously crystallised out of ordinary soap (technically known as 'figging' of soap) or out of aqueous soap jellies. Lawrence[1] has shown that though soaps of the very unsaturated acid like stearolic acid form microscopic crystals, the soaps of the saturated acids show it in the ultramicroscopic region. However, crystals of the acid soaps of the fatty acids can be readily prepared and McBain has published photographs of crystals of potassium hydrogen dioleate[2] and of sodium hydrogen dipalmitate[3] formed inside the melt of a mixture of neutral soap and fatty acid. McBain[4] holds that solid soap may be of two types, (i) lamellar crystals or (ii) soap curd, the latter being the more common and ordinarily producible. Of course, the soap curd fibres are really crystalline, having three-dimensional crystal regularity as indicated by X-ray evidence, though under the highest magnification even with the electron microscope, no trace of definite crystal faces are seen.[5] Thiessen and Stauff,[6] however, succeeded in producing a few crystals of sodium



Na-Stearate Crystals. × 120



K.-Stearate Crystals. × 120

stearate by a very laborious method from alcoholic solution, but they failed with sodium palmitate and laurate. Lawrence[7] in a study of soap gelation showed the existence of very irregular crude crystals of soap in soap gels in Nujol by microscopic method. This difficulty in the crystallisation of soap has precluded, so far, the employment of a crystallisation method for final purification of soap obtained by neutralising, say, alcoholic stearic acid with caustic soda.

The author has been successful in preparing crystals of alkali metal salts of long chain fatty acids. So far, the chief difficulty has been to prepare a good solvent for soap, since no organic solvent is known, in which soap dissolves to any considerable extent at low temperature. The author has surmounted this difficulty by discovering suitable mixtures of organic solvents which have powerful solvent action on soap at room temperature. The compositions of such suitable solvent mixtures have been published in a recent note.[8] On cooling such solutions, three things may happen, (i) the solution may form a transparent to translucent gel; (ii) the solution may separate a curdy precipitate or coagulum; or (iii) crystals may appear. Two or more of the above behaviours may even simultaneously occur, and what will happen depends generally on various factors, such as the composition of the mixture, the degree of supersaturation, the rate of cooling, etc. By adjusting these factors, it has been possible to prepare a good crop of soap crystals easily visible through an ordinary lens. Some microphotographs, taken in reflected light, are reproduced here. The crystals of stearates and palmitates of sodium and potassium are of the same type and were all formed at room temperature, and they have been photographed without separation from the mother liquor. These crystals consist of lamellar needles, which have a peculiar tendency to grow into foliage shape or criss-cross structure, similar to that observed for acid soap.

The crystals can be filtered out from the mother liquor, and can be properly washed and isolated. Hence, this method can be utilised for purification of ordinary alkali metal soaps by crystallisation. That even the typically amorphous substances, like proteins, resins, soaps, etc., can be crystallised under proper conditions has been amply proved by the recent crystallisation of many proteins, enzymes, etc., and the present observation only confirms this view showing that alkali metal soaps are no exception to the rule.

S. R. PALIT.

Indian Lac Research Institute,
Namkum, Ranchi,
December 18, 1941.

[1] *Kolloid-Z.*, 1930, **50**, 12.
[2] *J. C. S.*, 1927, 1392.
[3] *Ibid.*, 1933, 920.
[4] Alexander's *Colloid Chemistry*, **1**, p. 138.
[5] Vold and Ferguson, *J. A. C. S.*, 1938, **60**, 2066; Marton, McBain and Vold, *Ibid.*, 1941, **63**, 1990.
[6] *Z. Phys. Chem.*, 1936, A **176**, 397.
[7] *Trans. Farad. Society*, 1938, **34**, 660.
[8] Palit, *Curr. Sci.*, 1941, **10**, 436.

A SIMPLE AND EFFICIENT METHOD FOR THE DISPERSION OF CALCAREOUS SOILS

PROPER dispersion of soils is an important prerequisite for carrying out the mechanical analysis. The international method of dispersion is satisfactory for many soils; but highly calcareous soils resist dispersion.[1] The black cotton soils belong to this class, and the exact cause of this behaviour has been a puzzle.[2] Our experiments with a Mysore black cotton soil (from the Government Experimental Farm, Hiriyur) confirmed the above result. A systematic investigation has revealed that the resistance to dispersion is not due to (a) organic matter, or (b) ferric or aluminium ions. It is mainly caused by the presence of calcium ions.

Since the resistance to dispersion is due to the presence of calcium ions, we have tried to overcome this by using calgon (sodium hexametaphosphate) which is well known to fix calcium and magnesium ions in the form of soluble complexes. The exact procedure adopted by us is as follows: 50 g. of soil are soaked overnight in 350 c.c. of water containing 0·32 g. of sodium hydroxide and 2·0 g. of sodium hexametaphosphate. The suspension is then stirred by means of Bouyoucos stirring apparatus for fifteen minutes and made up to a litre with distilled water. The silt and clay are determined after sedimentation for an appropriate interval of time, employing the buoyancy technique developed in this laboratory.[3] A few experiments were also tried omitting the addition of sodium hexametaphosphate with a view to find out the influence of hexametaphosphate on the extent of dispersion. The results are given in Table I.

TABLE I

Expt. No.	Dispersion using sodium hydroxide alone		Dispersion using sodium hydroxide with sodium hexametaphosphate	
	% silt	% clay	% silt	% clay
1	25·6	35·7	13·3	47·3
2	25·4	35·8	14·2	46·4
3	26·6	35·7	19·8	45·2
4	27·2	35·4	19·3	46·7
Average	26·2	35·7	16·7	46·4

The results show that the addition of sodium hexametaphosphate increases the yield of clay by about 10 per cent. Moreover, we may point out that we get a higher percentage of clay by the new method of dispersion than by the International methods or by Puri's method. The process of dispersion itself is extremely simple and very quick. We believe, it is the best for calcareous soils and possibly for other soils too. We have found that the addition of considerable quantities of calcium chloride does not materially affect the extent of dispersion in presence of the hexametaphosphate whereas, without the latter even small amounts of calcium chloride considerably reduce the

amount of clay. The details of these investigations will shortly be published elsewhere.

(Miss) G. Sharada Bai.
K. S. Gururaja Doss.
Basrur Sanjiva Rao.

Department of Chemistry,
Central College,
Bangalore,
January 10, 1942.

[1] G. W. Robinson, *Imperial Bureau of Soil Science, Technical Communication*, 1931, No. 17, p. 8.

[2] —, *Soils, their Origin, Constitution and Classification*, 1932, p. 323.

[3] (Miss) G. Sharada Bai, basrur Sanjiva Rao and K. S. Gururaja Doss, *Proc. Ind. Sci. Cong.*, 1942, p. 206.

A CHEAP SUBSTITUTE FOR AMYL ALCOHOL USED IN THE DETERMINATION OF FAT IN MILK

Of the numerous methods in use for the estimation of fat in milk, the one due to Leffmann-Beam as modified by Gerber is widely adopted by dairy workers. This method entails the use of pure Iso-amyl alcohol. This commodity, having gone up considerably in price due to war, now selling at Rs. 14–22 per pound, attempts were made to find out a cheaper substitute for the same without in any way sacrificing the accuracy obtainable by the Gerber's method, and the one that suggested itself was Fusel Oil, a by-product in the alcoholic fermentation of molasses. The fusel oil obtained from Messrs. Carew & Co., Ltd., Rosa, Shajahanpur, U.P., contains about 60 per cent. of iso-amyl alcohol in addition to various other alcohols and costs Re. 1–8–0 only per gallon of 10 lbs.

Comparative determinations of fat in milk were made by the standard Gerber's method on the one hand and by the same method substituting fusel oil in place of amyl alcohol on the other, with the following results. The quantity of fusel oil required for a determination is the same as that of amyl alcohol.

The accompanying table shows clearly that there is a very close agreement between the two methods. The low cost of fusel oil combined with the accuracy obtained by its use must recommend itself to those engaged in milk testing. It is suggested, however, that a comparison with the Standard Gerber's test be once made, every time a fresh consignment of fusel oil is received, to be sure that it is of the desired quality.

Source of Milk	Percentage of Fat		
	Gerber's method	Fusel Oil method	
Cow Rajbhani ..	6·0	6·0	Fusel Oil from Waldie & Co.
,, Lakhurki ..	5·7	5·7	
,, Nahmohini ..	10·7	10·8	
,, Edadai ..	6·4	6·4	
,, Charuki ..	6·5	6·5	
,, Edmohini ..	10·8	10·8	
,, Emdungi ..	10·6	10·6	
,, Edwa ..	5·5	5·5	
Milk from the Nutrition Room, I. A. R. I. ..	5·9	5·9	Fusel Oil from Carew & Co.
House sample A ..	5·4	5·4	
,, ,, B ..	4·8	4·8	
Local Buffalo Milk ..	4·1	4·1	

K. Swaminathan.

Imperial Agricultural Research
Institute, New Delhi,
November 27, 1941.

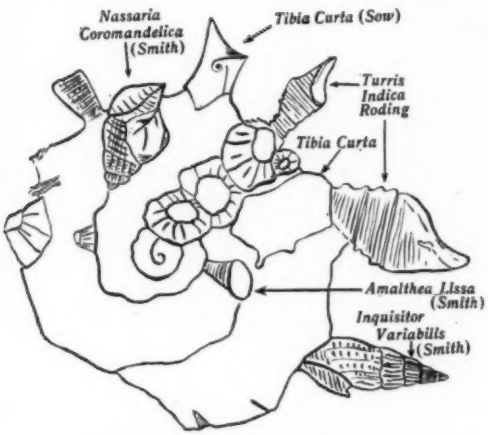
SHELL-FISH FISHED BY THE STEAM TRAWLER "LADY GOSCHEN".*

It would be interesting to readers whose hobby is conchology to hear about some interesting finds made by the Steam Trawler "Lady Goschen", a fishing vessel which was employed by the Madras Government to investigate the possibilities of deep-sea fishing in the seas of Madras Province from 1927–30.

One of the most remarkable animals included in the hauls made off Negapatam from 75 to 80 fathoms was *Xenophora pallidula* Reeve,† a handsome spire-shell which had agglutinated to itself both live and dead shell-fish as will be seen in the sketch. Attached to the base were found several living specimens of *Amalthea* (*Mallurium*) *lissa* (Smith). The dead shells were *Turris indica* Roding, *Inquisitor variabilis*

* Published with the permission of the Joint Director of Industries and Commerce, Madras.

† I am indebted to Mr. R. Winckworth of the Royal Society, London, for naming most of the shells mentioned in this paper.



Xenophora pallidula (Rv.) 75/80 FMS. off Negapatam

(Smith), *Nassaria coromandelica* Smith, *Tibia curta* and other unidentifiable fragments of shells.

Another spire-shell in the same area which was abundant was *Murex tenuispina* a well-known species, but the shell was rather finer and with more spines than are found in those occurring in shallow water. One was not able to estimate the accurate number of specimens brought by a haul; for their delicate spines got frequently entangled in the meshes of the trawl net preventing them from falling on to the deck. Many were the complaints from the members of the crew whose bare feet had been lacerated by the sharp ends of the spines when they happened to tread unwarily on the nets. Two boring molluscs from the same area were included in the hauls, *viz.*, *Arca divaricata* (Sowerby) and *Lithophaga malaccana* (Reeve).

Specimens of the nudibranchs *Phyllida multituberculata* and of another unidentified specimen of *Phyllida* were fished off Madras from 39|50 fathoms on 24th September 1930. Specimens of the prosobranch *Lamellania* (*Coriocella*) *semperi* Bergh. with an internal shell related to *Natica* and *Cypræa* were also fished from the same area. Most of the black coral trees (*Antipathes sp.*? and *Aphanipathes sp.*?) and Gorgonid trees brought on deck by the trawler when she trawled on the Wadge Bank off Cape Comorin and off Negapatam and Point Calimere had clinging to their branches several specimens of the aviculid *Pteria macroptera* Lamarck and of the oyster *Ostrea pectinata*. In the former were occasionally found living as its commensal the remarkable fish *Fierasfer sp.* previously recorded only from holothurians.

A list of the other molluscs fished by the S.T. "Lady Goschen" is given below:—

(1) *Harpa conoidalis* Lamarck, off Madras, 24–9–1930, from 17 fathoms, one with animal and the one with hermit crab.

(2) *Babylonia spirata* (L.) off Madras, 24–9–1930, from 17 fathoms, one shell with hermit crab.

(3) *Voluta vexillum* Gmelin, off Madras, 24–9–1930, from 17 fathoms, one specimen.

(4) *Amusium pleuronectes* (Linne), off Madras, 24–9–1930, from 17 fathoms, two specimens.

(5) *Siliquaria muricata* (Born), off Madras, 24–9–1930, from 17 fathoms, several specimens.

(6) *Fusinus forceps* (Perry), off Negapatam, 14–9–1930, from 21 fathoms, eight specimens.

(7) *Pteria semisagitta* (Lamarck), off Madras, 15–9–1927, from 35 fathoms.

(8) *Bursa rana* (L.), off Porto Novo, 1–7–1930, one specimen from 26 fathoms.

(9) *Strombus dentatus* Linne, off Pondicherry, 18–9–1930, one young specimen from 17 fathoms.

(10) *Armina formosa* (Kelaart), off Negapatam, 11–9–1930, two specimens from 76 fathoms.

(11) *Ficus investigatoris* (Smith), off Point Calimere, 10–9–1930, two specimens from 75–80 fathoms.

(12) *Tibia curta* (Sowerby), off Malpe, 30–11–1930, one specimen from 19 fathoms.

D. W. Devanesen.

Dept. of Industries & Commerce,
Madras,
January 2, 1942.

REVIEWS

The Chemical Action of Ultra-violet Rays. By Carleton Ellis and Alfred A. Wells. Revised and enlarged edition by Francis F. Heyroth, University of Cincinnati. (Reinhold Publishing Corporation, New York), 1941. Pp. ix + 961. Price $12·00.

This well-known book on photochemistry which appears in its second and very much revised and enlarged edition is characterised by comprehensiveness. It is divided into four parts. The first part gives a very complete account of the various sources of ultra-violet radiations, continuous and discrete, available at the moment, together with chapters on related topics such as filters and glasses permeable to these radiations. The second part on "photochemical processes" begins with an admirable short account of molecular spectra and their meaning to photochemical phenomena and gives a masterly account of the various known photochemical reactions in all three states of matter, organic and inorganic. The last two parts deal with the innumerable and evergrowing applications of photochemistry to industry and of ultra-violet rays to biology. In these, a fairly detailed account is given of the service rendered by spectroscopy in general and ultra-violet radiations in particular to various problems in applied biology and to such various industries as, preservation of foods, oils, paints, varnishes, rubber, textiles, paper, dyestuffs, leather, petroleum, gum, tobacco, alcoholic beverages, asphalt, fertilisers, linoleum, etc. In each part, references to original papers are given with a thoroughness which is necessary. The work will no doubt be of immense and constant use not only to persons working in photochemistry but also to those who are interested in industry in general. R. K. A.

Reports on Progress in Physics. Vol. VII, 1940. (The Physical Society, London), 1941. Pp. 362. Price 22/6.

The latest number of *Reports on Progress in Physics*, Vol. VII (1940), published by the Physical Society of London is the second volume of the series which has come out after the war broke out. It is interesting to note that neither the size of the Report nor the quality of the matter has suffered on account of the war.

The present volume begins with two articles, one on Sound, and the other on Musical Acoustics, both by Dr. Richardson. He has summarised the advances in these subjects in his usual comprehensive manner. The next article is by Dr. Wright on "Photoelectric spectrophotometry and its applications to Industry". This is followed by two other articles dealing with the technical applications of science, one by Dr. Lee on "New Lens Systems" and the other on "Electron Microscopy" by Dr. Klemperer. One of the topics dealt with by Dr. Lee is the increasing use to which the Schmidt reflector is being put in the design and construction of astronomical telescopes. The growing use of the Electron Microscope in Medicine and Microbiology is the subject-matter of an interesting article by Dr. Klemperer. At the beginning of the article Dr. Klemperer gives a clear account of the construction and working of the Electron Microscope with appropriate diagrams. Photograms are reproduced to show how the Electron Microscope is a distinct improvement over the Optical Microscope in virus research where the size of the virus which is beyond the resolving power of the Optical Microscope is clearly within the range of the Electron Microscope.

Advances in Classical Physics are represented by an article on 'Surface Tension' by Dr. Brown and another on 'Equations of State' by Dr. Beattie and Dr. Stockmayer. One would have thought that these two subjects were fairly completely understood, but from a perusal of these two articles it becomes clear that the last word has not been said on these familiar topics. Messrs. Francis and Jenkins have written a comprehensive article entitled 'Electrical Discharges in Gases and their Applications' Part I. The authors have discussed briefly the present position in regard to our knowledge of this subject and further have outlined the lines on which progress is being made. It is a pity that the more useful part dealing with the practical applications of the phenomena treated could not be included in the present volume. The

next article is one on 'Some Interactions of Gases with Metals and Crystalline Solids' by Dr. Roberts. This report makes very interesting reading, no doubt due to the fact that Dr. Roberts himself has been responsible for a considerable portion of the developments embodied in the article. This is followed by a report on 'Viscosity and the Nature of Substances of High Molecular Weights in Solution' by Dr. Eirich. It is unfortunate that this article is without a bibliography so necessary in reports giving recent advances. We are told that this was due to the internment of the author while engaged on this report. Advances in Astrophysics are treated in two articles, one by Dr. Thackeray on 'Solar Physics' and the other by Dr. Hunter on 'The Absorption of Light in Interstellar Space'.

The article by Dr. Feather dealing with 'Gamma Radiations Emitted during Nuclear Processes' deserves particular notice. The whole subject is surveyed in a comprehensive manner. No one who wants to get acquainted with the present position in regard to this intriguing phenomenon connected with nuclear processes could afford to ignore this very interesting Report. The other article on Modern Physics is by Dr. Peierls on 'The Bohr Theory of Nuclear Disintegration'. This deserves special mention for the clear and lucid manner in which he has made a difficult subject intelligible to the average reader. He has achieved this by confining himself mainly to the phenomenological aspect of the theory.

Last comes a very readable article by Dr. Ferguson dealing with the history of 'The Development of the Teaching of Experimental Physics in British Universities'.

In conclusion, we warmly recommend this volume to all those who wish to keep themselves abreast of the latest developments in the realm of contemporary Physics.

B. V. R.

A Text-Book of Electricity and Magnetism. By G. R. Noakes. (Macmillan & Co., London), 1941. Pp. x + 513. Price 8*sh.* 6*d.*

Of the many text-books on electricity and magnetism so far available, the needs of the B.Sc. students of Indian universities were best met by the well-known book of Starling. That book, particularly in its most recent edition, was so good that we could not recommend a better one to our students. Here we have before us now a book which bids fair to outrival 'Starling'. On account of the fact that in this book modern developments have not been added during a process of revision, but the treatment is uniformly modern throughout, it will have a distinct advantage for some time to come over new editions of well-established texts. The even balance between pure theory and technical applications maintained in this work will recommend its adoption in preference to others where one or the other aspect has been stressed. The treatment is throughout elegant and the uniform use of the calculus has no doubt contributed to this happy result. Without sacrificing a thorough presentation of the older material, the author has succeeded in incorporating adequate descriptions of modern advances such as the Van de Graaff generator, hot cathode lamps, the M. K. S. system of units, recent determinations of the electronic charge, mass-spectrographs, electron optics, electron configurations in atoms, artificial radioactivity, the cyclotron, Heisenberg's theory of Ferromagnetism, cosmic rays, the mesotron and so on. The illustrations are numerous and well chosen. There is a set of problems at the end of each chapter and some hints for the solution of difficult ones are included at the end. The price is also moderate and compares favourably with that of similar books. We have no hesitation in recommending this book as being eminently suited to fulfil the requirements of the pass degree examinations of Indian universities.

T. S. S.

Electrotechnics (The Honorary Secretary, *Electrotechnics*, Indian Institute of Science, Bangalore), 1941. Price Rs. 2.

This is the fourteenth number of the Journal of the Electrical Engineering Society which is published once a year. The issue opens with an "Editorial" which is mainly devoted to the consideration of the relation between industrial research and industrialisation. This is perhaps a topic of special significance at the present time and some of the observations made in the course of the Editorial are interesting. It is pointed out that a mere programme of industrial research—however successful—cannot automatically lead to the industrialisation of the country. Successful research and its subsequent exploitation are two distinct problems, each beset with its own peculiar difficulties.

After describing briefly the manner in which this problem was solved by countries which were similarly situated as India is to-day, warning is given that it may turn out to be a mere waste of time and energy to concentrate on researches connected with industries which have been already highly developed elsewhere. Finally, indication is given as to what type of industrial researches are likely to prove most useful at the present time.

The Editorial is followed by a number of articles of a technical nature. These may be divided into two groups—those dealing with problems in Heavy Electrical Engineering and those dealing with problems in Light Current Engineering. In the first group there is an interesting article by Prof. E. W. Marchant describing the recent development in the Liverpool University Laboratories, thus giving information on the progress that is being made in the teaching of Electrical Engineering in Great Britain. In the second group there is an article entitled "Whistling Meteors" which reports a very interesting discovery made by the Research Department of the All-India Radio.

The articles on the earthing of neutrals and on an alteration to an X-ray unit, as also the note on Kelvin's Law, should be specially interesting to the field engineers. Standard tests on broadcast receivers form the subject-matter of an article which describes the equipment and the procedure adopted in carrying out these tests, while in another article are described briefly the processes of manufacture of fixed resistors for radio purposes. There is a topical article on the "Cyclotron", its construction and use.

Towards the end of the issue a special section is devoted to the Department of Electrical Technology, Indian Institute of Science, which gives useful and interesting information for all those connected with the Department. Other interesting items are, Book Reviews, List of Members of the Electrical Engineering Society, etc.

The Journal is maintaining its usual high standard both as regards the nature of the contents and the get-up and an important point which may be mentioned in this connection is that this is the only journal of its kind published in India.

Manufacture of Dry Cells in India. Bulletin No. 23 of Indian Industrial Research. By Joglekar, Subbramaiah and Verman.

This Bulletin is the result of more than six years' research carried out by three workers in the Research Department of the Alipore Test House. It gives a brief account of the theory of dry cells and goes on to describe in some detail their construction and operation and the raw materials and machinery used for their manufacture. The methods used for testing dry cells, defects and their remedies, etc., are also described. A short account of the economics of dry cell manufacture is also included and the Bulletin concludes with an excellent bibliography of the available literature on the subject which will be of very great use to would-be manufacturers and others interested in dry cells.

The information given in the Bulletin will serve as an excellent introduction to scientists, manufacturers and others who are not very familiar with the subject, but it is very doubtful if it will enable any one, who is not already something of an expert in the line, to produce dry cells of good quality without carrying out a considerable amount of experimental work himself. On the other hand, it is only fair to point out that would-be manufacturers could probably get any information not found in the Bulletin by consulting the authors. Most of the technical information contained in the Bulletin will be found scattered in the literature. There are a few important points, however, worth mentioning. One of these is a process (patented by two of the authors) for activating natural manganese dioxide which enables the output of dry cells to be increased by fifty per cent. Such activated manganese dioxides have been on the market for some years but were hitherto entirely of foreign origin. The authors have also devised a number of hand- and power-operated machines, for the various operations involved in the manufacture of dry cells such as the rolling of the zinc, the pressing of the dollies, etc. These machines are illustrated in the Bulletin and will no doubt prove very valuable.

A few errors of omission might perhaps be pointed out. No mention is made of the fact—well known to manufacturers of dry cells—that the state of hydration of the manganese dioxide has a profound influence on its depolarizing properties. Other things being equal, it has been found that a highly

hydrated ore has much better depolarizing properties than an ore with less water of hydration. In the account given of "Gelatinizing substances", no mention is made of potato starch which is a much better gelatinizing agent than maize starch or wheat flour. It is also rather disappointing to find that nothing has been said about a somewhat novel type of dry cell using magnesium chloride instead of the usual ammonium chloride. The "Pertrix", a German make of cell, belongs to this type and was claimed to possess several advantages, over the ammonium chloride cell, particularly with regard to shelf life, a very important factor to be considered in tropical countries. On the whole, the Bulletin is a very useful publication and every would-be manufacturer of dry cells ought to possess a copy. C. V.

CENTENARIES

Halley, Edmund (1656-1742)

EDMUND HALLEY, a British astronomer, was born at Haggerston, London, November 8, 1656. He was educated at St. Paul's School and at Queen's College, Oxford. At the latter place he specialised in astronomy so remarkably that he was only 19 when the Royal Society accepted his first paper on the *Orbits of primary planets.*

The preparation of a new star catalogue was his ambition. But finding that project already pursued by Havellus and Flamsteed, he planned to supplement their work by the addition of the stars round the South Pole. For this purpose, he left the university before he had taken any degree and sailed for the island of St. Helena in 1676. He returned home with his catalogue of stars in 1678 when the Royal Society elected him a fellow, and Charles II gave him a mandamus to the University of Oxford for the degree of A.M.

His application for the Savilian professorship of astronomy at Oxford was rejected in 1691 on religious grounds.

Having visited the continent and having sailed in the Atlantic on various scientific missions he ultimately succeeded Dr. Wallis as professor of geometry at Oxford in 1703. Here he soon employed himself in translating from Arabic to Latin the works of Apollonius. In 1721 he succeeded Flamsteed as Astronomer Royal and devoted the next eighteen years to the duties of his office, hardly ever missing an observation.

One of the most remarkable services of Halley to science is the part he played in bringing Newton's *Principia* to the notice of the world. In January 1684 Wren offered Hooke and Halley a prize in the shape of a book worth 40 shillings if they would deduce the elliptic orbit from the law of inverse squares. Halley went to Cambridge and asked Newton, "What path will a body describe if it be attracted by a centre with a force varying as the inverse square of the distance?" Newton at once replied, "An ellipse with the centre of force as one focus". "How on earth do you know?" asked Halley in amazement.

"Why, I have calculated it", Newton said and began searching for the paper.

Halley found the papers to form a complete treatise on motion in general. With this burden of transcendental value, he hastened to the Royal Society, who wrote to Newton asking leave that it might be printed. When the consent came, Halley himself saw it through the press and met the entire cost.

The long life of this versatile man was devoted completely to the enrichment of several departments of knowledge both as an original contributor of 84 papers to the *Philosophical transactions* and as the Assistant Secretary and Principal Secretary of the Royal Society from 1685 onwards. His papers were all collected in three volumes under the title *Miscellaneous curiose.* His reputation as an astronomer rests on his discovery of the long inequality of Jupiter and Saturn and of the acceleration of the mean motion of the moon, on his prediction of the return of Halley's comet and on his suggestions for determining the solar parallax from observations on the transit of venus. His contributions to physics relate to terrestrial magnetism and optics. In pure mathematics, which he pursued only in leisure hours, he investigated the properties of loxodromic curve, first solved the problem of describing a conic section of which the focus and three points are given, improved the method of constructing curves of the third and fourth degrees and devised a new method for the tabulation of logarithms. His extensive voyages laid the foundation of physical geography and particularly meteorology. As the compiler of the *Breslau table of mortality,* he takes rank as the virtual originator of actuarial science.

In 1737, Halley was struck with paralysis in the right hand and when he was in the act of drinking a glass of wine, he expired in his chair without a groan, January 14, 1742.

S. R. RANGANATHAN
University Library,
Madras.

FERTILITY IN MAMMALS AND BIRDS

THE problem of fertility in mammals and birds has been critically and comprehensively reviewed by John Hammond in a recent issue of the *Biological Reviews* (July 1941), under three main heads:—(1) the number of ova shed, (2) the number of ova fertilised, and (3) the number of embryos developing to birth.

That the number of ova shed and fertilised does not depend on the number of ova present in the ovary in every species was demonstrated by several workers. It was shown that the number of follicles that ripened at any one time, did not depend on the mass of ovarian substances but it depended upon the age of the animal and the level of the gonadotrophic hormone of the anterior pituitary gland circulating in the blood. Considerable amount of work has been done on this hormone, the hormones of the urine of pregnant women and the hormone in the blood serum of pregnant mare. Of late, these hormones are being extensively used in the field to increase the fertility in mammals.

In early life, while growth is rapid the ovaries remain inactive and in old age, senility inactivates the ovaries. It is only in the middle age, that the maximum number of ova are ripened. As a result of several investigations, it has been shown that it is the age of the animal which influences the ripening of follicles and immature animals lack sufficient gonadotrophic hormones of the anterior pituitary circulating in the blood. Though the growth hormone and the gonadotrophic hormone of the anterior pituitary have something to do with each other, the exact relationship between them is not yet clear. In some species the lactogenic hormones in some way, inhibit the ripening of follicles.

Seasons definitely influence the rate of reproduction in mammals and birds; breeding is at the maximum in most of the species when the duration of the day is longer. This is due to the increased activity of the anterior pituitary gland stimulated by the nerves of the eyes which are acted upon by light rays. In non-breeding seasons the lowered output of the follicle stimulating hormone of the anterior pituitary may be raised by the injection of follicle stimulating hormone. But before fertility can be induced other conditions such as the occurrence of oestrus and correct timing of this in relation to ovulation must be satisfactory. Under these favourable conditions, successful mating and fertilising may be effected.

Ovarian cysts and a persistent corpus luteum interrupt the normal course of fertility. Ovarian cysts are of two kinds. The follicle, under certain conditions, does not rupture but progressively increases in size to form a cyst. In extreme cases the female with cystic ovaries assumes male sexual characters. Though the cause of cyst formation is not known, it can be artificially produced by injecting Prolan. The cysts either prevent further ovulation or produce large quantities of Oestrin which prevents the implantation of the ovum or cause abortion.

The number of ova fertilised is not only affected by the number and vitality of the sperm produced by the male but also by the duration of life of the sperm in the female genital tract and the time relation between mating and ovulation. The sperm and the ovum have a very limited independent life in the female tract and hence the chances of fertility are very remote if the time relations between mating and ovulation are not properly synchronised.

For maximum fertility it was observed that the production of large number of vigorous sperm is essential. In many of the mammal species defective sperm production leads to low fertilisation of the ova. Defective sperm production is produced by infections and obstructions in the tubules of the epididymis, faulty nutrition, deficiency in one or other vitamin, especially Vitamin E, the semen becoming alkaline under certain conditions and small differences in temperature.

Artificial insemination is playing an important role in the science of breeding. By this new method the fertility of males of high genetic value has been augmented. Recently, this has attained greater importance than the problem of curing certain forms of sterility in males.

In many species mating is limited to a short period of oestrus which occurs just before ovulation, and if mating does not occur within that short period the ovum is wasted. Other factors that affect fertility are the conditions in the female tract such as the presence of inflammation and leucocytes or the incomplete liquefaction of the mucus of the cervix at the time of oestrus.

During the course of pregnancy in mammals and incubation in birds, numerous conditions may interfere with the development of the embryo. In the event of conception, the corpus luteum formed at the ruptured follicles and progestin, the internal secretion of the corpus luteum, watch over the implantation of the embryo in the uterus and persist right through the pregnancy until a few days before the first oestrus following parturition. Under certain conditions, the progestin secretion is absent or deficient which leads to the failure of implantation. In certain species lactation at the period interferes with the process of pregnancy.

Progestin which is essential for the maintenance of pregnancy is produced also by the placenta. Under certain conditions the influence of Oestrin will over-ride that of progestin when, if it is in the early stages of pregnancy, absorption occurs, but in the later stages of pregnancy, abortion takes place. Certain infections as those due to Bang's bacillus and inflammatory conditions as those due to metritis also lead to abortion.

In many species certain lethal genetic factors will cause the death of one or more embryos at or before birth or hatching. In these cases only those embryos involved perish and others undergo the full term of development. These dead ones may become atrophied and mummified. There is every reason to believe in the existence of a substance in the blood which limits the number of young that develop normally to birth. The nature of this substance awaits future investigation.

K. SUBRAMANIAN.

SCIENCE NOTES AND NEWS

A Pyralid Caterpiller Pest—*Nephopteryx eugraphella* Rag.—on Sapota.—Messrs. M. C. Cherian and K. P. Anantanarayanan, Entomological Laboratory, Agricultural Research Institute, Coimbatore, write:—

The occurrence of this Pyralid caterpillar in pest form was first noted in Coimbatore in 1938. The same insect recurred again in a more virulent form in the summer of 1941. Very little is known regarding the life-history and control of this insect, though Fletcher (1920) has noted this pest elsewhere as early as 1920 on sapota and also on *Mimisops elengi*. During recent studies some useful information has been gathered on this insect.

The affected tree is readily recognised from a distance by the presence of numerous webbed shoots, dry leaf clusters and dark brown patches on leaves containing tunnels and frass of the caterpillar. The insect does a lot of damage to the leaves, and in addition, destroys a number of successive flower buds which eventually dry up and droop. The whole life-cycle is passed on the leaves and shoots. Eggs are laid on leaves and buds of tender shoots. After an egg period of 3 to 5 days the active larvæ bore into the buds or scrape the green leaves. Pupation is effected in folds of leaves and further sheltered by the tunnels of silken webs and frass after a varying larval period of 17 to 32 days. In about 7 to 12 days the moth emerges. The moth is greyish in colour, sluggish and rests on twigs during day. The moth is not easily detected, its colour pattern being well in harmony with that of the bark. A stomach poison, such as calcium arsenate is very effective in controlling this insect. Other cheaper insecticides are also being tried.

January 6, 1942.

Ancient Town Site at Arikamedu.—A few years ago Prof. Jouveau-Dubreuil and Frere Faucheaux of Pondicherry found ancient-looking beads and potsherds from a mound on the right bank of the Gingee or Ariyankuppam river near Kakkayantope village, south of Pondicherry. The site has been described by Prof. Jouveau-Dubreuil in *Bull. de l'Ecole Francaise de 'Extreme Orient*, 1940, **40**, 2. Among the remarkable surface finds was an oval carnelian plaque with the figure of Emperor Augustus. Prof. Jouveau-Dubreuil generously presented a collection of beads and potsherds to the Madras Government Museum. The beads, according to M. Cortenau, could be dated circa 500 B.C. The beads and pottery bore close resemblance to those from Buddhist sites of the Andhra country. Among the surface finds were terracotta figures of great excellence, coins of Andhra kings, various fragments of articles made of glass of diverse shades of colour, and sherds of ornamental grey ware and of cream coloured amphoræ.

Recent trial diggings brought from near the foundations of ancient walls, fragments of inscribed pottery, the characters of the inscription being Brahmi of the second century B.C. Some other characters on the pottery appear to be unreadable.

Arikamedu goes back thus to the early centuries of the Christian era, and is definitely the most ancient archæological site yet discovered in the Tamil country. The Government of French India are taking steps to protect the site and a Committee has been appointed to consider details.

A. A.

Tuberculina which belong to the group of Fungi imperfecti are hyperparasitic on many rusts. They possess hyaline conidia and smooth sporodochia. In Europe experiments have been carried out to use them as a means of controlling the devastating effects of the pine rust *Cronartium ribicola*. Hubert, Tubeuf and others report partial success in utilising *Tuberculina maxima* as a means of biological control of the pine rust. *Tuberculina costaricana* was collected by the writer on the Jasmine rust (*Uromyces Hobsoni*) round about Bangalore. The fungus parasitises pycnia and æcia of the Jasmine rust, and in most of the cases effectually prevents the development of teliospores. The suppression of the resting spore-form might prevent the perpetuation of the disease from season to season.

M. J. T.

Voltametric Determinations and Amperometric Titrations with a Rotating Microelectrode of Platinum Wire.—Current voltage curves obtained with various types of microelectrodes are discussed by Laitinen and Kolthoff (*J. Phy. Chem.* 1941, **45**, 1079). The advantages of the rotating platinum microelectrode, which gives a diffusion current proportional to the concentration in a medium of constant salt concentration, over stationary platinum microelectrode have been pointed out. Two types of rotating platinum microelectrodes are described in detail. The reduction of oxygen on the electrode has been studied using rotating platinum and silver plated electrodes. It has been found that oxygen is reduced at a less negative potential at the silver surface than at the platinum surface and further the diffusion current is not well defined with the silver electrode. Amperometric titrations of very dilute solutions of arsenite with bromate and silver with chloride using the platinum electrode are described. Use of gelatin is suggested to prevent the depolarising action of silver chloride. It is likely the method may be found useful in other specific cases. An explanation for the abnormal slopes of current voltage curves is given.

M. R. B.

Plate Factors in the Fractional Distillation of the Ethyl-alchohol-Water System.—The results of a very valuable study on plate efficiency,

carried out at the Engineering Experiment Station, Urbana, in a bubble cap column of four plates, operated without entrainment at vapour velocities 0·2 to 3 ft. per second and at reflux ratio L/V = 1, $^2/_3$ and $^1/_3$ have been published (*Bull. of the Univ. of Illi.*, 1941, No. 328). The plate efficiency was found to vary with the liquid composition but not significantly with reflux ratio or rate of distillation. The Overall Murphree efficiency rises from 80 to 100 per cent. from 10 to 60 mole per cent. alcohol, in the liquid and decreases to 60 per cent. at 80 mole per cent. alcohol. The local plate efficiency varies from 80 to 50 per cent. with 50 to 80 mole per cent. alcohol in liquid. It is interesting to note that the 'median' efficiency reaches a maximum in the range of maximum viscosity in the liquid, between 20 and 40 mole per cent. alcohol. As vapour bubble size varies inversely with liquid viscosity, at maximum viscosity, bubble size is minimum. The observation lends support to the condition of a formation of heavy froth, below the point of appreciable entrainment, considered by designers as necessary to maintain high plate efficiencies. The low efficiencies at the extremes of the composition range, where the diffusional driving force is small, cannot be definitely attributed to the influence of liquid composition. As these calculations are inherently unsatisfactory and sensitive to errors in sampling, etc., the actual performance of a distilling column cannot be predicted. Hence in practice a larger number of plates are provided to safeguard against variations in design and operation.

The above study presents a marked advance in the definite knowledge of several factors influencing distillation and the *Bulletin* is a useful guide to designers of plant as well as to research workers. The *Bulletin* includes a review of previous work, a discussion of efficiency calculations, experimental data, an appendix of physical data for ethyl-alcohol-water mixtures and a bibliography.

Y. K. R.

Mysore Geological Department.—The latest number of the *Records of the Mysore Geological Department* (Vol. XXXIX) begins with the Director's Annual Report on the administrative and technical work of the Department during the year 1939–40. Then there are six papers contributed by the officers of the Department dealing with various problems of scientific and economic importance investigated by them in the course of the year. Mr. B. Rama Rao, the Director, leads with an important paper on "The Charnockite Rocks of the Biligirirangan Hills". From his study of the rocks described by previous workers as Charnockites near Sivasamudram, Malvalli, Halagur and other parts of the State, Mr. Rama Rao has been expressing the view that "the zones mapped as Charnockites form a complex composed of a composite series of rocks of different ages and diverse modes of origin, all intensely metamorphosed, and that they cannot all be regarded as the differentiated phases of crystallisation of any single, plutonic, intrusive mass." The present paper deals with the Biligirirangan Hills area and embodies a detailed account of the typical character and the field relations of the several rock types found in this area which have been distinguished and mapped previously as Charnockites. A discussion of the wider aspects of the age relationship and the mode of origin of the Charnockites in general has been reserved for a separate paper to be published some time later. Mr. M. B. Ramachandra Rao's "Report on the Geophysical Survey near Guddadarangavanahalli in Chitaldrug District," is of particular interest as recording the results of a new line of investigation recently initiated by the Department, with the object of studying the practical application of some of the electrical methods for the location of ore bodies. After giving a brief outline of the general principles of the methods adopted, together with descriptions of the apparatus employed, Mr. Rao proceeds to describe in detail the actual field surveys carried out and discusses the interpretation of the results obtained. He concludes: "The investigations embodied in this report were largely of an experimental nature, and it has not yet been possible to fully verify the few important indications by actual prospecting work." The other four papers contained in the *Records* are: (*i*) Earth-salt Deposits in the Shimoga and Chitaldrug Districts, by Mr. N. M. Mallikarjunappa, (*ii*) Petrology of the Felsite and Porphyry dykes in Mysore, by Mr. B. N. Raghunatha Rao, (*iii*) Notes on Prospecting for Alluvial Gold round Kudurekonda and Palavanahalli, Honnali Taluk, Shimoga District, by Mr. B. P. Radhakrishna, and (*iv*) The Conglomerates of Kalavaranganbetta, Honnali Taluk, Shimoga District, by Mr. B. P. Radhakrishna, and all of these furnish valuable information on the topics dealt with.

Department of Chemical Technology, University of Bombay (*Annual Report*, 1940-41).—The Department has continued to maintain contact with the textile and chemical industries of the province, as evidenced by the employment of its graduates, the subsidies received for industrial research, and the increasing amount of analytical work and technical investigations submitted to the Department. Among others a wool research scheme has been started under the auspices of the Imperial Council of Agricultural Research for investigating the possibility of effecting improvements in the quality of Indian wool, and for setting up standards for Indian wool.

The foundation stone of the new buildings for the Department was laid in March 1941. It is planned that the Department will finally shape itself into a University College of Technology, with additional degree courses in 'Plastics, Paints and Varnishes', 'Oils and Fats', 'Paper and Cellulose Industries', Pharmaceuticals and Fine Chemicals', and 'Foods and Drugs'.

Irrigation Research.—Reports on the research work carried out at the various centres were reviewed and the programme for 1942 was drawn up at the 12th annual meeting of the *Central Board of Irrigation* held in Delhi recently.

The Board considered the work done relating to the staunching of canals to prevent leakage. Considerable work on the subject has already been done in view of its importance.

Some instances of the success of the measures adopted for carrying out model experiments were reported to the Board. One was the Beas river model, on which the construction of armoured "T" head spurs in the river Beas was decided. It was emphasised by the engineers concerned that if they had not had the model, the results of erosion might have been serious. The Board decided to collect further data comparing the behaviour of a prototype to that of its model, for various types of models.

Work done in connection with the meandering of rivers, design of channels in alluvium, the accuracy of different methods of taking discharges, and silt selective heads was discussed. Some channels taking off from larger ones draw excessive silt which causes considerable trouble in the off-taking channel. This, it was considered, could be remedied by a suitable design of head of off-take, *viz.*, a silt selective head, arranged to draw the correct proportion of silt. The design depended on many factors which differed at different sites. Model experiments were of great value in this connection. The Board asked the Research Committee to indicate the types of silt selective heads best suited to different conditions.

The design of silt excluders and ejectors was also considered as well as methods of calculating the head required to operate such devices. The silt excluder withdraws the heavy bed sand at the head-works and so prevents it from entering a canal, whereas a silt extractor is constructed on the canal to extract heavy silt or sand which is being carried down the canal.

One of the problems on which much research has been done in America is the deposit of silt in reservoirs year by year reducing their capacity. A large amount of data on the subject has also been collected in India and Burma. The subject is one of general interest to the Board, but particularly to those provinces which have in hand schemes for the construction of storage reservoirs, such as the Bakhara Dam in the Punjab.

Agricultural meteorology.—A number of new problems of practical importance to agriculture, which were suggested recently by the Agricultural Commissioner with the Government of India, are being dealt with by the Agricultural Meteorology Section of the India Meteorological Department. This Section was taken over by the Department in April 1940, as its work is of permanent value to Agriculture in India. The physics of sub-soil irrigation involving measurements of the rates of upward and downward movement of moisture through the soil from the sub-soil level, the wind-break effect of different crops as measured by the variation of wind velocity in the different environments with the help of a hot-wire anemometer, the effect of shade plants on the climate of tea-gardens, weather factors influencing the incidence of insect pests and the investigation of the influence of weather on cane and sugar tonnage per acre, are a few of the problems which are receiving the attention of the research staff.

Considerable attention is devoted to the development of new instruments for the use of agricultural workers in India. To facilitate the experimental work of the Section, the construction of a field laboratory at the Central Agricultural Meteorological Observatory was completed recently and an additional plot of land has been placed at the disposal of the Section by the authorities of the Agricultural College, Poona.

Fish Canning.—A "mobile cannery" with the canning plant installed on board a large sailing or power-propelled boat, as is often done in Japan, is suggested by the Agricultural Marketing Adviser to the Government of India as a more suitable method for developing the fish canning industry in India.

The Indian migratory fishes are rather erratic in their movement. They do not touch the shores of India each year with any degree of regularity. Further, the difficulties of transporting the catches (including 40 per cent. or more of non-cannable waste) from distant waters to the cannery on the shore form a serious problem in tropical climates. A mobile cannery is both convenient and economical.

Previous to the present war, on an average, 44,000 cwt. of canned fish valued at over 10 lakhs of rupees used to be imported into India from the United Kingdom, Canada, Norway and Japan. Fish canning industry in India has now assumed increased importance owing to supplies having been cut off from these sources.

Experiments in canning Indian fish were first conducted at an experimental canning factory opened by the Madras Government at Chalyam (Malabar) as early as 1911. These experiments showed that, besides oil sardines, a number of other fishes, such as mackerel, pomfret, Indian salmon and prawns, could be advantageously canned. The Government cannery, however, was not a commercial success and in 1933 was sold to a private party, who has re-equipped it not only for canning of fish but also of fruits and vegetables. Small lots of sardine and mackerel in olive oil have been prepared already. Efforts at canning Indian fish are being also made at two fruit canning establishments, operating at Bezwada and Bombay.

The average annual catch on the British Malabar and South Kanara sea fronts of the Madras Presidency is about 2,607,000 maunds, of which approximately 60 per cent. consists of varieties which are suitable for canning. They are: mackerel—985,000 maunds, oil sardines—371,000 maunds, prawns—108,000 maunds, seer fishes—40,000 maunds, pomfrets —10,000 maunds and beckti—5,000 maunds.

Canning and Food Preservation.—Canned and dried foods, particularly fruits and vegetables which on account of their vitamin content are of special value to troops, have assumed a special importance in view of the enormous

armies moving rapidly and operating at long distances from the base.

In order to secure easily transportable supplies of food in a form which will keep them intact in any climate, the Supply Department created a Food Directorate in 1940 with which the Imperial Council of Agricultural Research has been working in collaboration.

Manufacture of Surgical and Orthopaedic Instruments.—India is now a predominant instrument producer among the Eastern Group countries and practically 100 per cent. of hospital and operation theatre equipment and 98 per cent. of orthopædic instruments and appliances are now produced by the Indian industries.

Planning is in progress for the production during the next twelve months of five million instruments and appliances by the Indian surgical instruments industry.

The Medical Store Department has been the main instrument in developing the manufacture of surgical instruments in India. Some 25 years ago, a surgical instruments factory was established in Bombay. As Departmental demands increased it was found necessary to stimulate the production in other parts of India and now the surgical instruments industry is well established in Lahore and Sialkot in the Punjab.

Manufacture of Optical Instruments.—*The Mathematical Instrument Office*, Calcutta, has been performing an increasing amount of work for the Defence Services, particularly in respect of optical instruments. It is now manufacturing, in large quantities, binoculars (not hitherto produced in India), prismatic compasses and other optical instruments for the army, as well as mathematical and surveying instruments. Experiments have also been in progress for some time in the manufacture in India of optical glass.

Forest Research Institute.—A large volume of research of immediate interest to war industries, has been recently carried out at the Institute. To mention a few of its activities, investigations have shown that 75 per cent. of the timber used in modern aircraft (aircraft in its widest sense), is made up of short 10-feet lengths, and a careful selection of Indian spruce and fir can supply such timber. Certain other species, almost unknown and untested in time of the last War, have since been found which appear to answer the requirements. The Institute has also been making aircraft propellers in sissoo, walnut and Andamans *Padauk*. As the result of experiments, a sleeper creosoting plant at Naharkhatya in Assam has been reopened and will soon be treating green sleepers straight from the forest for the use of armies overseas. A special type of synthetic resin glue for plywood and laminated wood, which is an essential material for army supplies, has been evolved at the Institute.

A hot air seasoning chamber has been recently devised which is much cheaper to instal than an ordinary seasoning kiln.

A simple key to identify six-species of bamboos in their finished states as tent poles has been devised by the Botanical Branch of the Institute, helped by the Silvicultural Branch.

Manufacture of Newsprint.—Suitable mechanical pulp for use in the manufacture of newsprint quality papers has been produced at the Forest Research Institute, Dehra Dun.

For the production of the required mechanical pulp, the Paper Pulp Section of the Institute experimented with nine species of woods and one species of bamboo (*salia*). Five of the woods (*genwa, paper mulberry, chir, fir* and *spruce*) yielded fairly light-coloured pulps, suitable for use in the manufacture of newsprint quality papers.

Papers were produced on the Forest Research Institute's small experimental paper machine from a mixture of 70 per cent. mechanical pulp and 30 per cent. bleached bamboo chemical pulp, and their strength characteristics were determined. With fir and spruce, the proportion of mechanical pulp and bamboo pulp was 75 per cent. and 25 per cent. respectively, and the papers produced from these woods were comparable in strength to the average imported "newsprint" papers.

Fir and spruce are available in Kashmir and Tehri Garhwal States in sufficiently large quantities to support a small newsprint mill. The proposals for the establishment of a mill in each of these two States has, however, had to be held up till after the war, for various economic and technical reasons, the chief of which is the abnormally high capital investment required for putting up a mill at the present time.

The remaining four species of wood and the *salia* bamboo, yielded brown or brownish coloured pulps. These pulps on account of their brown colour were not considered suitable for the production of newsprint quality paper, but they can be utilised for the manufacture of certain cheap lines of paper, such as cheap printing and wrapping papers, triplex boards and cheap cardboards.

Experiments are now in progress to find out a cheap and economical method of bleaching or lightening the brown colour of mechanical pulp, especially from bamboo, as this material (bamboo) is available in India in large quantities.

New Uses for Jute.—The December issue of the Indian Central Jute Committee's *Bulletin* contains some interesting information on several new uses of jute. Production of a cork substitute on a patented jute waste base has commenced in Calcutta. A new method for making felts on jute fibre base has recently been patented. Felts produced according to this method are claimed to be rot-proof, termite-proof, waterproof and resistant to heat of the sun.

Another announcement of considerable interest is the reported use of jute by the Ford Motor Company as a base for a plastic composition for the manufacture of car and truck bodies.

ASTRONOMICAL NOTES

Planets during February 1942.—Mercury after inferior conjunction with the Sun on February 10, passes into the morning sky. Venus also will be in inferior conjunction on February 2 and during the latter part of the month will be visible in the morning sky for about a couple of hours before sunrise. On February 22, the planet will be at one of the stationary points of its geocentric orbit. Mars is in the evening sky and although gradually decreasing in brightness, its ruddy colour makes it a prominent object among the stars in the constellation Taurus.

Jupiter will be on the meridian at about sunset and continues to be bright enough to attract attention. Saturn is in quadrature with the Sun on February 11 and can be seen as a star of the first magnitude in the western sky during the early part of the night. The planet will be in conjunction with Mars on February 24 when the angular distance between the two will be a little over three degrees. Uranus will be stationary on February 3 when it resumes its slow eastward motion among the stars in the constellation Taurus. On February 15, the planet is in quadrature with the Sun. An occultation of considerable interest that can be observed with the naked eye is that of the first magnitude star Aldebaran (*a* Tauri) which will occur in the early part of the night on February 23. The disappearance of the star as well as the reappearance will be visible in India.

T. P. B.

MAGNETIC NOTES

December 1941, was slightly less active than the previous month. There were 13 quiet days, 16 days of *slight* disturbance, one of moderate disturbance and one of great disturbance during December 1941, as compared with 6 quiet days, 22 days of slight disturbance and 3 of moderate disturbance during December 1940.

The day of the largest disturbance during December 1941, was the 1st when a magnetic storm of great intensity was recorded. The quietest day was the 20th.

Characterisation of individual days was as follows:—

Quiet days	Disturbed days		
	Slight	Moderate	Great
5, 11, 12, 15, 16, 19–22, 26, 28, 30, 31	2–4, 6–10, 14, 17, 18, 23–25, 27, 29	13	1

During December 1941, one storm of great intensity was recorded as against one of moderate intensity recorded during December 1940. The mean character figure for the month was 0·65 as against 0·90 for December 1940.

M. R. RANGASWAMI.

SEISMOLOGICAL NOTES

During the month of December, 1941, one great, three moderate and three slight earthquake shocks were recorded by the Colaba seismographs as against one moderate and seven slight ones recorded during the same month in 1940. Details for December are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.	Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
December 1941		H. M.	(Miles)		(Miles)	
6	Great	2 17	10580	Lat. 0°, Long. 90° W. Off Equador (S. America)		
7	Moderate	2 55	10510			
9	Slight	8 13	3520			
13	Slight	11 46	3110			
17	Moderate	0 50	3130	In the neighbourhood of Formosa Island		
23	Slight	16 59	1380	Apparently in Tibet		
26	Moderate	20 18	1850	Lat. 20° N., Long. 101° E. To the east of Burma on the border of Thailand and Indo-China	Probably about 60–80	

ANNOUNCEMENTS

Indian Science Congress, 1943.—The next session of the Congress will be held at Lucknow from January 2–8, 1943. PANDIT JAWAHARLAL NEHRU, Chairman, National Planning Committee, will preside over the session.

The following have been elected Presidents of the different Sections:—*Physics*: Dr. H. J. Bhabha (Bangalore); *Chemistry*: Dr. S. S. Joshi (Benares); *Geology and Geography*: Lt.-Col. E. A. Glennie (Dehra Dun); *Botany*: Dr. K. Biswas (Calcutta); *Zoology*: Dr. B. N. Chopra (Calcutta); *Anthropology and Archæology*: Dr. N. Chakrabarti (New Delhi); *Medical and Veterinary Sciences*: Dr. F. C. Minett, (Mukteswar); *Agricultural Sciences*: Rao Bahadur Y. Ramachandra Rao (Bangalore); *Physiology*: Dr. B. Narayana (Patna); *Psychology and Educational Sciences*: Dr. B. L. Atreya (Benares); *Engineering and Metallurgy*: Prof. K. Aston (Bangalore).

Ramalinga Reddy Sastyabdapurti Commemoration Volume, Part I—Sciences.—The learned articles that were presented by scientists from different parts of India to Dr. C. R. Reddy, Vice-Chancellor, Andhra University, on the occasion of his *Sastyabdapurti* in December 1940, have now been published in a collected form. The sale proceeds will be utilized for the benefit of the Andhra University to which Dr. Reddy's donations amount nearly to half a lac of rupees. As only a limited number of copies are available, intending purchasers are requested to register their orders early with the Registrar, Andhra University, Waltair.

A new service of **Biological Abstracts.**—To meet the requirements of men engaged in the animal industries, *Biological Abstracts* announces the establishment of a new section, *Section F, Abstracts of Animal Production and Veterinary Science*, beginning January 1942.

The biological research literature on the breeding, nutrition, husbandry, diseases and pests of the domesticated animals—including poultry, fur-bearing animals and pet stock—is scattered throughout a large number of original research journals in many languages, and its assembly, in the abstract issues and indexes of a single comprehensive abstracting journal will, it is felt, be a great convenience to all who are working in the broad field of animal production.

The new section will consist of ten abstract issues per year. The annual subscription rate will be $5. Subscribers will receive the index to the complete edition of *Biological Abstracts*.

Section F will contain all of the abstracts published in *Biological Abstracts* that have to do with the breeding, nutrition, and metabolism, husbandry, reproductive and other physiology, anatomy, pathology and parasitology, and arthropod pests of live-stock, poultry, and semi-domesticated animals and birds, including pet stock.

Biological Abstracts now covers some 1,450 periodicals—thus the new abstracting section will, from the beginning, afford a very complete coverage of the biological literature pertaining to the animal industries.

Inquiries should be addressed to *Biological Abstracts*, University of Pennsylvania, Philadelphia.

Dr. B. V. Narayanaswami Naidu, Annamalai University, has been elected President of the Economic Conference, to be held in December 1942, at Madras.

Ceylon Journal of Science.—The Editor-in-chief, *Ceylon Journal of Science*, informs us that the publication of "Spolia Zeylanica" issued in December 1941 from the Colombo Museum as Vol. XXIII, Part I, has no connection whatever with the *Ceylon Journal of Science*, the Editorial Board of which disclaims any responsibility in connection with the said publication.

Indian Research Fund Association.—The attention of our readers is drawn to an advertisement appearing in the December 1941 issue (Vol. 10, No. 12), inviting applications for five Research Fellowships of the value of Rs. 150 each per mensem under the Indian Research Fund Association. Applications should reach the Secretary, I.R.F.A., Secretariat, New Delhi, not later than 7th February, 1942.

* * *

We acknowledge with thanks, the receipt of the following:—

"Journal of Agricultural Research," Vol. 63, Nos. 4-6.

"Agricultural Gazette of New South Wales," Vol. 52, Pt. 11.

"Journal of the Indian Chemical Society," Vol. 18, No. 9.

"Chronica Botanica," Vol. 6, Nos. 17-18.

"Experiment Station Record," Vol. 85, Nos. 4-5.

"Indian Forester," Vol. 68, No. 1.

"Indian Farming," Vol. 2, No. 12.

"Indian Journal of Genetics and Plant Breeding," No. 1, Dec. 1941.

"Bulletin of the American Meteorological Society, Vol. 22, No. 8.

"Journal of the Indian Mathematical Society," Vol. 5, No. 3.

"Journal of the American Museum of Natural History," Vol. 48, No. 3.

"Nature," Vol. 148, No. 3755.

"Canadian Journal of Research," Vol. 19, No. 8.

"Sky," Vol. 1, No. 1.

"Indian Trade Journal," Vol. 143, Nos. 1851-53; Vol. 144, Nos. 1854-55.

Books

"The Cytoplasm of the Plant Cell," by Alexandre and Guilliermond. (The Chronica Botanica Co., Waltham, Mass., Macmillan & Co., Ltd., Calcutta), 1941. Pages 247, Price $4.75.

"Landscape as developed by the processes of normal erosion," by C. A. Cotton. (Cambridge University Press, London), 1941. Pages xviii + 301. Price 21*sh*.

ACADEMIES AND SOCIETIES

Indian Academy of Sciences: (*Proceedings*)

December 1941. SECTION A.—R. D. DESAI AND F. FIGUEREDO: *Studies in the Friedel-Crafts reaction. Part VII. The action of phthalic and succinic anhydrides on resorcinol derivatives.* S. V. ANANTAKRISHNAN, S. ARAVAMUTHACHARI AND V. S. GOVINDARAJAN: *A study of the constituents of the seeds of* Croton sparsiflorus (*Morung*)—*Part I.* S. V. ANANTAKRISHNAN, S. ARAVAMUTHACHARI AND V. S. GOVINDARAJAN: *A study of the constituents of the seeds of* Croton sparsiflorus (*Morung*)—*Part II. Chemical examination of the components.* K. GANAPATHI, M. V. SHIRSAT AND C. V. DELIWALA: *Chemotherapy of bacterial infections. Part V. Synthesis of* 2-N^1-*sulphanilamido-5-alkyl- and* 2-N^1-*sulphanilamido-4-methyl-5-alkyl-thiazoles.* N. V. R. IYENGAR: *Modified methods for the determination of total alkali, sulphate, nitrate and phosphate in highly coloured solutions of high organic matter content.* The analysis of highly coloured and turbid effluents has been much simplified by the previous oxidation of colour and organic matter by hydrogen peroxide under suitable conditions. P. SURYAPRAKASA RAO AND T. R. SESHADRI: *The colouring matter of the flowers of* Tagetes patula: *Isolation of a new flavonol, patuletin and its constitution.* Patuletin is represented as 3 : 5 : 6 : 3′ : 4′-pentahydroxy flavone. B. R. SETH: *Finite strain in a rotating shaft.* BIJAN BIHARI LAL: *Decomposition of hydrogen peroxide by sodium nitroprusside.* The photo-chemical after-effect in the reaction between hydrogen peroxide and sodium nitroprusside is due to the photo-formation of sodium aquo penta cyano ferrate. MISS S. PANKAJAM: *Ideal theory in boolean algebra and its application to deductive systems.*

SECTION B.—B. SAHNI: *Indian silicified plants. I.* Azolla intertrappea *Sah. & H. S. Rao.* K. CHIDAMBARAM: *Observations on the development of* Arius jella (*Day*). L. S. S. KUMAR AND A. ABRAHAM: *Cytological studies in Indian parasitic plants. I. The cytology of* Striga. M. C. CHERIAN AND M. S. KYLASAM: *Preliminary notes on the parasites of the spotted and the pink bollworms of cotton in Coimbatore.* A. R. SRINIVASAN: *Cyto-morphological features of* Limnanthemum cristatum *Griseb. and* Enicostemma littorale *Blume.* K. BHASKARAN NAIR: *On the embryology of* Squilla.

Indian Chemical Society: (*Journal*)

September 1941.—S. S. BHATNAGAR AND M. SARUP: *Adsorption properties of synthetic resins.* T. B. PANSE, R. C. SHAH AND T. S. WHEELER: *Some new reaction of* 1-*Benzylidenecoumaran-2-ones. Part I.* JAGANNATH GUPTA AND ANIL KUMAR MAJUMDAR: *Raman spectra of substituted sulphuric acids. Part I.* P. C. MITTER AND PHANINDRA NATH BAGCHI: *Studies in long-chain acids. Part III. On* bis-*nor-Oleic acid.* V. S. PURI AND S. R. SETH: *The effect of colloids on the electrodeposition of nickel on copper.* PARESH CHANDRA DUTTA: 9-*Thiophenanthrene and some of its derivatives.* B. N. GHOSH: *On the velocity of hydration and dehydration of nickel sulphate.* PARESH CHANDRA DUTTA AND RAMANI MOHAN SINHA: *Azine derivatives from* 9 : 10-*Phenanthrathiophene-2′* : 3′-*dione.* S. N. JOSHI, R. K. KAUSHAL AND S. S. DESHAPANDE: *Structure of oxymethylene methyl ethyl ketone and of oxymethelene methyl-β-phenyl ethyl ketone.* (MISS) ASIMA MOOKERJEE: *The alkaloids of* Rauwolfia canescens, *Linn. Part II.* N. C. SEN-GUPTA AND P. R. SINHA: *On the moving boundary method for the determination of cataphoretic speed of colloids. Part II.* KESHO DASS JAIN AND B. L. VAISH: *Reaction between glucose and iodine in alkcline medium. Effects of neutral salts.* RAFAT HUSAIN SIDDIQUI: *A note on an isomer of dimethylethylpyridine.*

Royal Asiatic Society of Bengal:

January 5, 1942.—FRANKLIN P. METCALF: *Notes on* Cayratia *and* Tetrastigma. The systematic position of the two specimens collected in Hainan in 1921 and 1922 by Prof. McClure which had hitherto been variously interpreted as *Columella Wrayi* (King) Merrill or as *Cayratia papillata* (Hance) Merrill and Chun has been clarified.

A comparison of the available photographs, drawings and merotype show that the species of King, originally described as *Vitis Wrayi* and that of Hance, originally described as *Vitis papillata* are the same and that they both represent species of *Cayratia* and not *Tetrastigma.*

Gagnepain, Merrill and Chun, and more recently Biswas (in litt.) consider this to be a *Cayratia*, not a *Tetrastigma*, though Craib has placed his Siam material under *Tetrastigma.*

The early material from Hainan collected by McClure is something entirely different; it is a species of Tetrastigma, apparently undescribed, and is here proposed as a new species.

SUPPLEMENT TO CURRENT SCIENCE

Vol. XI] INDIAN SCIENCE CONGRESS, BARODA, 1942 [No. 1

Summaries of Addresses of the General President and Presidents of Sections

PRESIDENTIAL ADDRESS

General President: D. N. WADIA, Esq., M.A., B.Sc., F.G.S., F.R.G.S., F.A.S.B.

THE MAKING OF INDIA

THE sub-continent of India consists of two crust-blocks of different nature and constitution, the rigid Archæan shield of Deccan and of the 1,600 miles long folded beds of younger rocks (the Himalayas). Their interaction has produced the third physiographic division of India—the North Indian Plains—built by the alluvial deposits of rivers of the Indo-Gangetic system. These great plains of India cover a trough or depression in front of the earth-waves of the Himalayas passing from Tibet against the immobile crust segment of the Deccan.

The unravelling of the structural features of these three units of earth-body, integrated into one sub-continent, has been India's contribution to the world of science.

In the structure of India, the folded zone has played a comparatively minor part and that also during the last one or two chapters of its history, having but lately emerged from a Central Eurasian sea. This zone bears evidence of great compression whereby the country between Tibet and the Ganges valley has been shortened by 60–80 miles.

The Indo-Gangetic Plain is the newest part to be added to the edifice of India and is still not complete. It has grown almost wholly within the human era by the extension of the flood-plains and deltas of the river systems belonging to the Ganges on the east and to the Indus on the west.

The other structural unit—the Peninsular India—is a non-flexible, obviously impassive block composed of ancient, crystalline rocks which has, since the dawn of Geological history, acted as a peg in the earth's crust. This unit has not attracted so much attention from Geologists as the extrapeninsular region. The old view, that the mountains of Deccan are not true mountains of uplift but are mere relics of an old plateau, is now being gradually given up. Although it is beyond doubt that the segment of India, south of the Aravalli-Hazaribagh line has never been submerged, *en masse*, under the sea since the Cambrian era, or wrinkled into mountain-chains, it bears scars of several periods of earth-movements, though of a kind quite different from the mountain-building movements. Recent geolcgical work carried out by Mr. Wadia in Ceylon has greatly strengthened the new belief. In some respects, the structure of Ceylon furnishes the key to the tectonics of South India.

Ceylon, though an island to-day, is an integral portion of the Carnatic gneissic terrain only recently severed from the mainland, and still connected by Adam's Bridge spanning a shallow strait, only five fathoms deep.

The field Geological work so far carried out in this area indicates, beyond doubt, that the Ceylon mountains are not the undenuded passive remnants left out of an old table land, but have been 'created' by positive earth movements, lifting them vertically in two intermittent, widely separated stages. They are what are known as 'fault mountains' in contrast to the folded, laterally compressed, mountains of the Alps and Himalayan type.

On purely physiographic grounds, Adams made a very suggestive observation in his paper on Geology of Ceylon (1929), that the Deccan plateau represents a continuation of the second peneplain of Ceylon and that the third peneplain of Ceylon might be found in the uplands of the Nilgiris whose highest peaks have approximately the same elevation as the culminating point of Ceylon.

A remarkable parallelism of many of the Ceylon phenomena is detected in the Nilgiri-Palni hills, and their southern extension, the Cardamom hills, which for hundreds of miles have their western, and still more prominently, their south-eastern sides bounded by gigantic precipices. As in the Ceylon mountains, these precipices may not be due to single fractures, but to a system of faults, more or less vertical, in their inclination. They form, in many cases, most striking features of the South Indian landscapes. The Nilgiri-Palni hills and their southern extensions are not the residual stumps of an eroded plateau but are upraised mountains with an orographic axis.

The peninsular India has suffered a series of multiple basin-faulting. The severance of Ceylon from India, the straight and steep contour of the Malabar Coast and the easterly drainage of peninsular India can be traced to this multiple basin-faulting. This type of faulting has given to the Deccan a block-mountain and fault-basin structure. The Indian Peninsula, thus, though still a rigid shield, is not an unbroken unit.

The remaining orography of Peninsular India is represented by the tectonic chains of Aravalli and the Eastern Ghats, all but worn away and now existing mainly in their roots. Once of a size comparable with the Himalayas of to-day, these mountain ranges have played a large part in the succession of geological ages and their detrital waste has furnished the raw material of the principal rock systems of India.

The Vindhya and the Satpura chains, which form the main divide of North and South India to-day, are not of as great geological antiquity. There is some evidence that in the early Eocene they were non-existent and that a northerly drainage flowed across their site to Central Deccan. These prominent lines of steep south-facing cliffs, like the cliffs of the Western Ghats in the Konkan, have been produced, by parallel linear faults, now usurped by the valleys of the Narbada and the Tapti. Though of tectonic origin, these ranges have no axis of folding or compression.

A large section of the Deccan possesses the simplest geological structure possible. This section, covering an area of nearly 200,000 square miles, is built up of flat-reposing sheets of lava, forming a pile from 2,000 to 6,000 feet high, completely burying the ancient geography of the land. Time has sculptured this lava plateau into imposing hills, valleys and plains, but these high hills are only the few outstanding portions of the plateau that have withstood weathering, and have no pretensions to be classed as mountains of elevation. They have no orographic axes of folding, but have remained in their original position and attitude. At the time of its completion, this volcanic formation, known as the Deccan trap, must have covered a much wider extent both in area and altitude, and nearly 400,000 cubic miles of molten rock was poured out from the bowels of the earth during this volcanic period —a volume of rock exceeding both in bulk and mass that represented by the entire body of the Himalayas, and of an average density one-tenth higher than that of the Himalayas.

In the making of India the constructive geological processes have only given the broad outlines of the country; the shape or figure of India, as we see it to-day, is determined essentially by the destructive processes of Nature. The sea, rain, rivers and other atmospheric agencies of change, by their ceaseless action have cut deep into the profile of India and have removed thousands of feet of matter from off the surface producing the existing sculpture of the land.

PHYSICS

President: PROF. B. B. RAY

SOME ASPECTS OF X-RAY INVESTIGATIONS ON SOLIDS, ELECTROLYTIC SOLUTIONS, ALLOTROPES AND COLLOIDS

IN the first part of the address Prof. Ray gives a brief review of the electronic theory of metals outlined by Sommerfeld and modified by Periels, Brillouin, Bloch and others, with special reference to soft X-ray 'emission' and 'absorption' edges in solids. This simple theory neglects the lattice structure altogether and treats the valence electron in a metal as a free electron gas. Mott and Jones have modified the theory by taking into consideration the crystalline lattice field. This modified theory is shown to explain satisfactorily the difference in the structures of 'K' and 'L' emission bands of the elements of the first and second groups, which the simple theory fails to account for. However, many important characteristics of the emission and absorption spectra of solids do not find an adequate explanation on the basis of any of the existing theories. The problem is complicated by the uncertainty of the experimental measure of band-widths, caused by the 'tailing effect' of bands, the presence of 'satellites', the overlapping of the absorption and emission edges, and the superposition of the spectra of elements and their oxides formed on the anti-cathode. Further refinement of the experimental method may be expected to throw fresh light on the electronic theory of solids.

The second part of the address deals with the results of investigations carried out by Dr. Ray on the Debye-Scherrer patterns of the allotropes of sulphur, selenium and tellurium, in the crystalline, amorphous, molten and colloidal states. Many of them hitherto known as amorphous are shown to be crystalline. As is to be expected the diffraction photographs show close resemblance in the liquid and amorphous states. The conditions under which the colloidal sols of these elements are crystalline or amorphous are obtained and a mechanism of coagulation is also suggested. The address also deals with secondary absorption spectra of aqueous solutions of iron and cobalt salts of varying concentrations.

CHEMISTRY

President: DR. M. QURESHI

CERTAIN ASPECTS OF PURE AND APPLIED PHOTOCHEMISTRY

AFTER a brief reference to the relative importance of pure and applied research and the great need for a full co-ordination between the two, certain aspects of pure and applied photo-chemistry have been presented.

Strictly speaking the photo-chemist is concerned only with the chemical changes taking place as a result of interaction between matter

and radiation. A proper understanding of the primary act of light absorption and other physical changes connected with this act is however essential for the correct interpretation of the photo-chemical changes that follow. When radiation acts on an atom, an electron may rise to a higher level or may leave the atom producing ionisation. When radiation acts on a molecule, the several possible primary processes are: (*a*) a change in the rotational state, (*b*) changes in the rotational and vibrational states, (*c*) changes in the electronic, vibrational and rotational states, (*d*) dissociation into atoms immediately on absorption of light, and (*e*) dissociation after a redistribution of the absorbed energy. These primary processes are followed by the secondary processes such as (*a*) fluorescence, (*b*) dissipation of excitation energy by collisions of the second kind, (*c*) transfer of energy to another molecule, and (*d*) chemical reaction. In the case of simple molecules, it is possible to draw definite conclusions about the nature of the primary processes by a study of the absorption spectra. But with complex molecules, definite conclusions can only be reached by combining photochemical and spectroscopic investigations.

The quantum yield for the primary process of activation or dissociation is obviously unity. But the over-all quantum yield may vary within wide limits on account of secondary effects. Dissipation of energy as heat or occurrence of a reverse reaction can make the over-all quantum yield less than unity; while a chain reaction may lead to values considerably greater than unity.

GEOGRAPHY AND GEODESY

President: Mr. George Kurian

SOME ASPECTS OF THE REGIONAL GEOGRAPHY OF KERALA

KERALA, the country which lies on the south-western corner of India, cut off from the east coast and the Deccan by the barrier of the Western Ghats, is characterised by a system of backwaters which has exercised considerable influence on the political, commercial, and industrial activities of the country. Beginning with a brief account of the geology of the country, the address proceeds to deal with the climate of this region which is characterised by a striking uniformity of temperature and a fairly abundant rainfall. Then follows an account of the agriculture of the country. The wet lands constitute slightly less than one-third of the total area under occupation, and here rice is practically the only crop cultivated; in the dry and garden lands are grown the perennial crops like coconut, arecanut, jack, mango, cashew-nut, etc., and some root crops like tapioca, yam, and vines like pepper and betel. The question of the density and distribution of the population in Kerala is next considered, and it is shown that a close connection exists between the density of population, the proportion of the cultivable and cultivated lands, and the kind of crops cultivated. Taking note of the rapid rate at which this population is increasing, Mr. Kurian raises the question, "What solution can then be offered for feeding these increasing millions?" A certain amount of industrialisation may "alleviate the suffering, but it may not in itself be able to cure the ailments. Agricultural improvements are certainly called for, and perhaps they are the fundamental sources which are likely to yield results of a more permanent value .... What is actually needed is a new outlook on agricultural enterprise among the governments and the landed aristocracy in the region."

BOTANY

President: N. L. Bor

ECOLOGY: THEORY AND PRACTICE

THE plant geographer has need of a framework of classification of vegetation into which he can fit the facts as he finds them in nature. It is clear that if a system which takes cognisance of ecological concepts be adopted it will be logical and satisfactory. In the past many systems have been formulated which have taken plant form, plant physiology, floristic and so forth as a basis, but none of them have been entirely suitable.

The most modern systems (Clements, Tansley) adopt the dynamic standpoint of the succession of vegetation as their basis. There can be little doubt of the soundness of the basic conception though the conceptions of climax and succession are still in the melting pot. Clements postulates that (1) succession is due to reactions only and is always progressive and (2) that climax is governed by climate alone. This view is adopted by many on logical and philosophical grounds. On the other hand the theory that succession may be forwards, backwards or sideways and that instead of one climax governed by climate there may be several governed by soil, climate or biotic factors, is also accepted by many. Recent discoveries, that podsols are found in low-lying tropical areas and that these bear a vegetation different from that found on adjoining tropical red earths seem to lend some weight to the polyclimax theory.

Whatever may be the ultimate verdict of science upon the theories enunciated above it is clear that the dynamic conception of vegetation is particularly useful when dealing with problems concerning vegetation not yet established, and that, considered as an instrument for the control of the entire range of human uses of vegetation, the conception of succession is unrivalled.

On the other hand the climax is less flexible than the stages of succession. Man can however enrich or impoverish it; it can be destroyed in such a way as to reproduce itself or it can be destroyed so completely as to render its reappearance impossible.

One important fact which emerges from the discussion of climax is that the tropical forest

lives largely upon the products of its own decay. If this be true, and there is little doubt of it, it follows that a luxuriant evergreen forest is no criterion that the soil upon which it is growing is a fertile one. Failure to appreciate this fact has often resulted in forest land being thrown open to cultivation and to its abandonment after a few years when the accumulated fertility due to plant remains alone, had disappeared.

The many problems which arise in India today, due to man's contact with vegetation, such as those connected with forestry, agriculture, grazing, shifting cultivation and so on, must be approached from the ecological angle and dealt with according to the principles of applied ecology.

Erosion, which is causing much concern, at the present time in the Punjab, is due to ascertainable causes and can be prevented by the application of certain principles of plant succession. These and similar problems can be solved by experiment and research based on ecological conceptions.

ZOOLOGY

President: Dr. H. Srinivasa Rao

THE URGENT NEED FOR BIOLOGICAL STATIONS IN INDIA

FIFTEEN out of eighteen universities in India have Biology as a subject for their graduate or post-graduate courses. In the early days the student of Biology in India had to be content with the blackboard and text-book knowledge of this subject. Gradually he has been supplied with preserved specimens and also practical handbooks dealing with indian types for his study. In recent years good amount of research has been done in india both in Zoology and Botany but mostly confined to the study of structure and classification with the aid of preserved specimens. For nearly seventy years a new complexion has been given to the teaching and research in biological subjects in Europe with the inauguration of Marine and Freshwater Biological Stations. The main purpose of a Biological Station is to provide facilities for the study of animals and plants in their live condition. In India there are no Biological Stations, except the newly started Marine Biological Station of the Travancore State, either on the long stretch of sea coast or on the shores of the numerous vast lakes, although desultory surveys have shown that the wealth of animal and plant life in our rivers, lakes, estuaries, back-waters and seas is infinitely greater than those of temperate climates.

There are immense possibilities of the development of fisheries in India. The bionomics and the life-history of no important Indian fish has yet been worked out, and the European Biologists who are acquainted with Indian conditions rightly attribute the lack of this knowledge to the absence of Biological Stations in India.

The persistence with which the question of establishment of a Marine Biological Station for India has come up during the last ten years before the Indian Science Congress is an indication of the realization by biologists in this country of its importance and urgency. The address pleads for united efforts on the part of biologists, universities, scientific bodies and public men in India to convince the governments concerned of the urgent necessity of establishing Biological stations all over the country and the useful purpose they would serve by promoting knowledge as an instrument of culture and of developing the fisheries with a view to increase the food supply of the country thus giving the masses more nourishment and employment.

ENTOMOLOGY

President: Mr. D. Mukerji

CERTAIN ASPECTS OF MORPHOLOGY OF INSECTS IN RELATION TO HABIT

THE physiological aspect of insect morphology in relation to habit, with special reference to the basic functions of respiration and reproduction, forming the essential subject-matter of the address, is discussed in the case, mainly, of acquatic beetles of the genus Cybister and pulse beetles of the genus Bruchus.

The correlation existing between habit and structure in the larva of Cybister beetle is made clear by a detailed study of the structure of the respiratory mechanism and the natural positions and postures of the larva in the act of feeding and respiring while near the surface of water on submerged weeds, and when below the surface. The special peculiarities in the structure of the lateral and the terminal pairs of abdominal spiracles, are found significant in the light of the functions that devolve on those spiracles. But whether the habit of the larva after it dives under water chasing the prey, to come up to the surface at shorter or longer intervals, is regulated by the oxygen deficiency or excess of carbon-dioxide in the respiratory tubes, must still remain a debatable point. The specialisation in structure and function of the mesothoracic and terminal abdominal spiracle is most marked.

In the larva of the pulse beetle, Bruchus *quadrimaculatus* Fabr. the existence of 4 pairs of large ovalshaped air-bladders connected with the tracheal trunks is most peculiar; they evidently store a large quantity of respiratory air, and should be regarded as adaptive organs to meet the special requirements of respiration in a closed cavity of the seed, in which the larvæ develop into beetles.

By the study of the peculiar structure of the spiracles of the queen termite (*Termes redemanni* Wasm) and the nature and function of the brownish granular substance ejected through the spiracular apertures, the author makes certain interesting suggestions worthy of consideration.

In the case of the function of reproduction, the relation of structure to habit, has been discussed with reference to the reproductory systems and the genitalia of two species of Bruchus, namely, quadrimaculatus and chinensis. The importance of the structure of the genitalia, in the maintenance of physiological or sexual isolation in insects is pointed out; but in the case of the two species of pulse beetles studied, the structure of the genitalia, does not seem to the author to be an effective bar against the interbreeding of the species. If this should be the case, the question whether hybrids are not present among so-called distinct species of Bruchid beetles infesting our stored products, assumes importance and a genetic analysis of the various species and the examination of their genitalia should be undertaken to decide the question.

ANTHROPOLOGY

President: DR. M. H. KRISHNA

PREHISTORIC DAKHAN

THE address reviews the races of India and proposes a provisional classification based upon recent researches. The history of the various races of India and their immigration to this country is then briefly discussed. The coming of the languages of India in their original form and their sequence is considered. The importance of a study of prehistoric cultures is noted and some of the paleolithic industries of the Dakhan are considered. Then a detailed study is attempted of the light thrown on the prehistory and protohistory of the Dakhan by the excavations at Chandravalli and at Brahmagiri in the Mysore State.

The antiquities of about 2,000 years ago collected at the excavated town of Chandravalli, show that it was the chief city of some local rulers, that it was an industrial town and that it was connected by trade with distant countries including Rome and China.

Brahmagiri in the extreme north of Mysore is a site containing the remains of the town of Isila which was much older than Chandravalli. This site was subjected to trial excavations and revealed the existence of stratified layers reaching back through the prehistoric iron age and the neolithic age to the microlithic age. By a study of the implements and pottery collected in these layers an attempt has been made to prepare a provisional index of the characteristics of antiquities belonging to the various prehistoric and protohistoric periods of the Dakhan, namely the microlithic, the neolithic, the chalcolithic, the iron age, the Mauryan period and the Satavahana period.

Finally the existence of a microlithic period preceding the neolithic is established and the possibility of a short-lived copper age intervening between the neolithic and the iron ages is suggested.

PHYSIOLOGY

President: PROF. B. T. KRISHNAN

THE NEED FOR THE EXPANSION OF PHYSIOLOGICAL AND PHARMACOLOGICAL RESEARCH IN INDIA

THE work carried out so far in the fields of physiology, pharmacology and medicine, in this country, is infinitesimal compared with the vast volume of research work that has been and is being carried out in the Western countries. Ways and means must be devised in various parts of our country for the advancement of medicine in its basic subjects and for turning out greater volume of research work. We are proud of the achievements of our ancestors and the ancient traditions and literature, but we cannot live, progress and compete with the other nations of the world on only traditions and glories of the past. We must progress in scientific thoughts and correlate our ideas of animal physiology with the rapid advances in our knowledge of physics and chemistry and apply the new ideas for the advancement of medicine and pharmacology.

Apart from the general problems in physiology which have an important bearing on the practice of medicine and which still require elucidation by further research, there are several special physiological and allied problems requiring urgent attention and investigation. These are problems of national nutrition, agricultural research, industrial physiology and medicine, physiological standards applicable to India, pharmacological research, with a view to substituting indigenous drugs in place of imported ones and pharmaceutical and biological industry with a view to make the country self-sufficient as regards supply of therapeutic agents, sera, vaccines, etc.

The universities in India should play an important part in the promotion of physiological and pharmacological research. The Government and the universities should afford all facilities for intensive research work in all their institutions teaching chemistry, natural science, physiology, biochemistry, pharmacology, pharmaceutics, bacteriology and medicine by providing well-equipped laboratories and special research assistants and by introducing special diplomas and degrees. Moreover, measures should be adopted for introducing the study of elementary biology, physiology, hygiene and nutrition in the curricula of studies in secondary schools.

MEDICAL AND VETERINARY RESEARCH

President: DR. C. G. PANDIT

IMMUNITY PHENOMENA IN VIRUS DISEASES

DEALING with the present conception of the highly complex problem relating to the mechanism of immunity in virus diseases, a detailed survey of the experimental evidence having a direct bearing on some aspects of this very important phenomena was made.

While the viruses in general exhibited an intimate type of parasitism, adequate knowledge of the vital processes involved when a virus invaded the susceptible cells was lacking. This is also true of other infections. It would appear that the defence mechanism of the infected host is the same whether the infective agent is a bacterium, a virus, or a protozoal organism. Agglutinins, precipitins and neutralizing anti-bodies are produced exactly as in bacterial diseases. If the virus is introduced in the fluids of the host, these anti-bodies are produced and the virus destroyed. The only difference, however, is in the action of the neutralizing anti-body. It is assumed that when the virus is in the body fluids, it unites with the anti-body and becomes susceptible to phagocytosis in much the same way as in bacterial infections. But once the virus enters the susceptible cell, the anti-body has no direct action on the virus. When such a cell divides, the virus will pass into daughter cells and as long as the process is kept up, it will maintain a latent infection or persistence of infection. If the cell is destroyed, the virus will be brought into contact with the anti-body in the surrounding fluid and will then be destroyed. More anti-body is also produced in this way. In case of neurotropic viruses, the virus can also make its way from cell to cell along the connected cytoplasmic processes and ultimately reach its central termination. During its sojourn, it will not come into contact with the anti-body at all, thus explaining the failure of specific immune sera in such infections as poliomyelitis. To this knowledge of the mechanism of immunity following infection, reference is made to Jungeblut's recent hypothesis drawing attention to another defence mechanism which is dependent on environmental factors such as heredity, sex, locality, etc.

Discussing the methods of application of the knowledge so gained in the prevention of virus diseases in man, attention is drawn to the relative merits and demerits, following the use of heat killed vaccines, formalinized vaccines, serum inactivated virus vaccines and attenuated vaccines in the prophylaxis of several diseases.

P. M. N.

AGRICULTURE

President: Dr. Nazir Ahmed

SOME TEXTILE FIBRES OF INDIA

THE textile fibres dealt with in the address are only the three fibres, *viz.*, cotton, jute and coir. As may be expected from the kind of work in which Dr. Nazir Ahmed has specialised, cotton occupies the first place and takes up the bulk of the address. As far as we are aware the various fibres of India have never received in any comprehensive manner any critical attention at the hands of the Presidents of the Indian Science Congress and for this reason we should much have desired that the other fibres too had been dealt with. Dr. Ahmed has, moreover, made a slight departure from usual practice by devoting considerable attention to the industrial and commercial aspects of these fibres as they may affect the production and profits of the cultivation as well as the larger and more far-reaching industrial possibilities and the general prosperity of the country. We welcome this special feature. In regard to cotton a general survey is made of the different problems in the cultivation of cotton which have been studied in the different provinces and the success achieved therein. An intensification of the efforts to popularise the results of all this work, generally with a larger measure of financial help from the Provinces and along well recognised methods of extension work, is called for and a strong plea is put in therefor. Though cultivation methods, irrigation, manuring, the baffling diseases, physiological and other conditions leading to crop failures, cotton wilt, boll and leaf-shedding, insect pests like the stem borers and boll weevils have all received attention, the bulk of the work everywhere has of course related to the introduction or evolving of superior varieties or strains, especially of those with longer or better staple. The Panjaub-American cottons, Sind Sea Islands, the Madras Cambodias, the improved Verums of the C.P., the Jubilee of the Panjaub, the Jayavant of Dharwar and other improved cottons are all touched upon in this connection. The disappointing fact that a high yield per acre does not go hand-in-hand with an improvement in staple length is referred to. We would rather stress this point as it is now claimed that judged by the money return per acre, the older strains score over the improved introductions. Dr. Ahmed calculates that in normal years India has to import about half a million bales of long staple cotton, but this cannot be produced locally unless it is made profitable to grow it. Further research alone can solve the problem. India on the other hand suffers from a big surplus of short staple cotton. Measures to expand Indian consumption of Indian mill-goods, a study for stimulating markets for Indian goods abroad, and the diverting of part of the output to other industrial purposes, of which a long list is given, are the remedies suggested.

In regard to jute, reference is made to the higher yielding varieties already made available and the need for research in retting methods, on the ultimate fibre characters of jute, for experiments in the spinning of finer counts of the yarn and the manufacture of the finer kinds of goods, so as to widen the uses to which jute can be put, is emphasised. The bleaching and softening and dying of the jute fibre, adapting it for waterproofing and rot-proofing are also desirable lines of research work.

In regard to coir, the lack of uniformity in the material as prepared now is pointed out and further work on the various aspects of retting is suggested. Work likewise is desirable especially with a view to improve the colour and quality of the fibre and to reduce the period of time now found necessary for the process. Alternative methods especially for preparing good fibre from the husks of ripe nuts, work on the softening, bleaching and dying as well as on making union fabrics with

other fibres are all indicated as important and promising lines of work. In respect of all the fibres dealt with the manufacturing side is emphasised so as to secure a wider utilisation and a larger market for the products.

A. K. Y.

ENGINEERING

President: Dr. Anant H. Pandya

EDUCATION FOR THE ENGINEERING INDUSTRY

IN his Presidential Address, Dr. Pandya has laid stress on the great and urgent need for the proper training of skilled personnel, a fundamental and vital aspect of industrial development. In spite of numerous technical institutions in India, he remarks, suitable and sufficient training for industries is scanty.

A few experimental technical schools have been started in Bombay and Hyderabad, as a result of Messrs. Abbott and Wood's report on "Vocational Education in India", published in 1937. Also a polytechnic has been opened at Delhi early in 1941. On the 28th July 1941, an Association of Principals of Technical Institutions (India) was formed with a view to co-ordinate the efforts of all Provincial Governments and private bodies and foster all-round co-operation between educational interests, industry and professional bodies.

The conduct of modern industry demands, as Mr. Abbott observes, "the services of men who have had a broad general education, on which they have built a first-rate scientific education". But for university men trained in scientific method, he points out, there would have been a serious dearth of men qualified to carry on research. In the United States, a number of curricula fairly similar is provided so as to enable students to transfer from one curriculum to another at the end of any term during that period, thus affording a freedom of choice among special fields. Humanistic and social subjects including the arts of expression (spoken and written) form part of an engineer's course and the introduction of these subjects in the syllabuses of our institutions, observes Dr. Pandya, deserves very careful consideration.

Research as an instrument of engineering education has not been fully recognised in India. In Great Britain and the United States, it has been accepted as a tenet that research can be used very effectively in the higher classes. Dr. J. C. Jackson observes that competent engineering is a research occupation. Dr. Pandya observes that in India, insufficiency of staff and financial resources of institutions, lack of co-operation between industry and educational institutions and overcrowding of undergraduate syllabuses hamper research. Institution of post-graduate courses which would include research and advanced professional subjects and permitting senior members of staff to have a certain amount of consulting practice, as in medicine, law and architecture would to some extent remedy this unhealthy defect. In India, recently a Board of Scientific and Industrial Research has been established and if the work is to develop rapidly on wholesome lines it is imperative that the training of research workers should be undertaken in a close co-operation with science and engineering colleges.

Industries and commerce must co-operate with technical educational organisations. Abroad, a noteworthy trend in higher technical education is the provision of co-operative courses between the college and works, enabling students to spend part of their time in college and a part in works. Most of the colleges in India, at present experience great difficulty in arranging even for post-graduate practical training of their students. Without a conscious demand from industry and without a close, regular and full co-operation of industry and commerce, technical education cannot progress. Many firms in Europe and America appoint special officers to supervise the practical training of students and Dr. Pandya suggests that our firms will do well "to extend their co-operation in this direction with immediate benefit to every one concerned".

We are at present on the threshold of a new era of industrial expansion. To enable our industries to develop without avoidable delay, it is imperative to bridge the gulf between industry and education and in the measure we are able to span this barrier, we will achieve that essential high technical efficiency, by the continual technical development of our industrial worker.

C. Gopalakrisna.

25-42—Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by B. N. Sastri, M.Sc., A.I.C., A.I.I.Sc., for the Board of Editors, "Current Science", Bangalore.